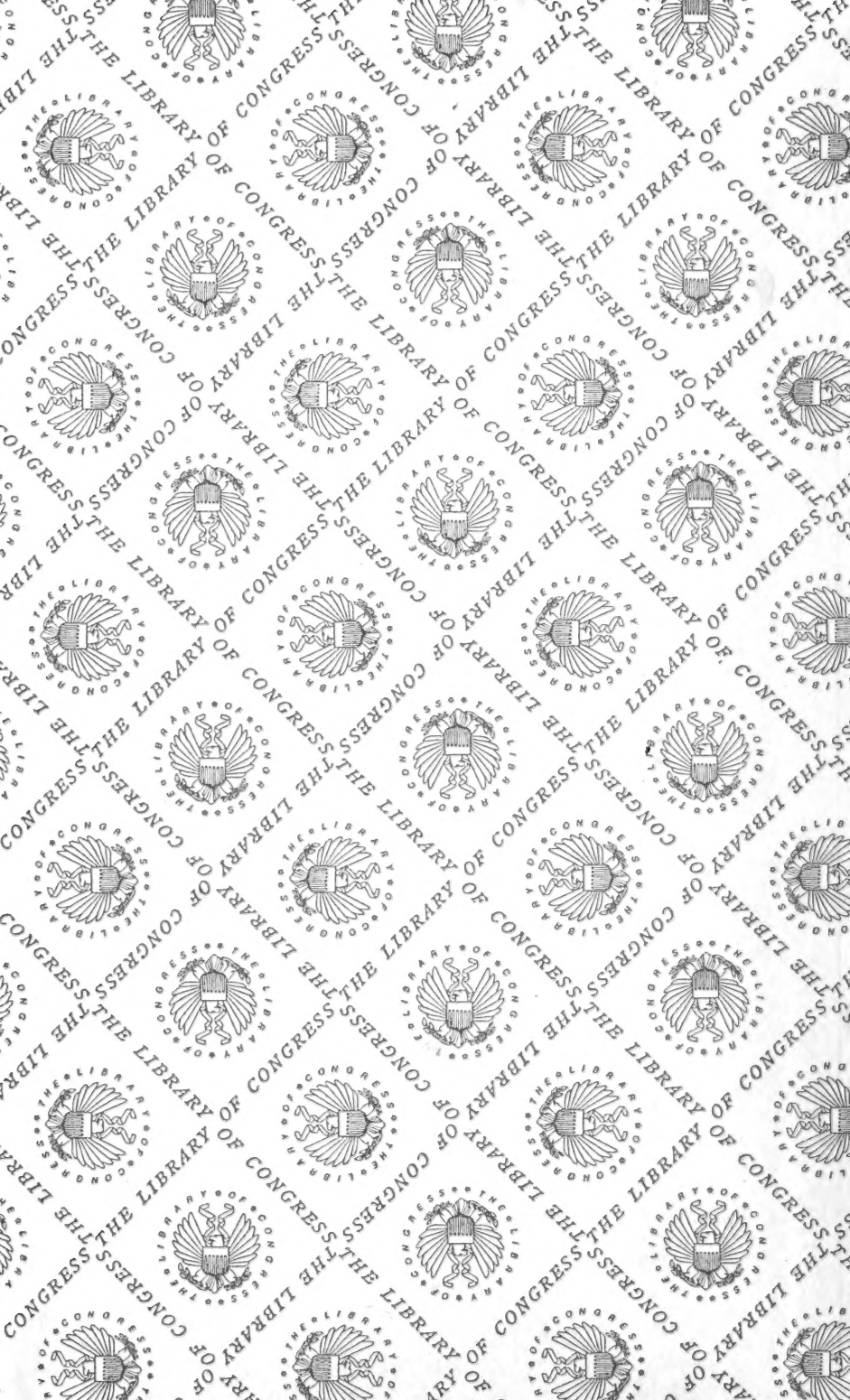
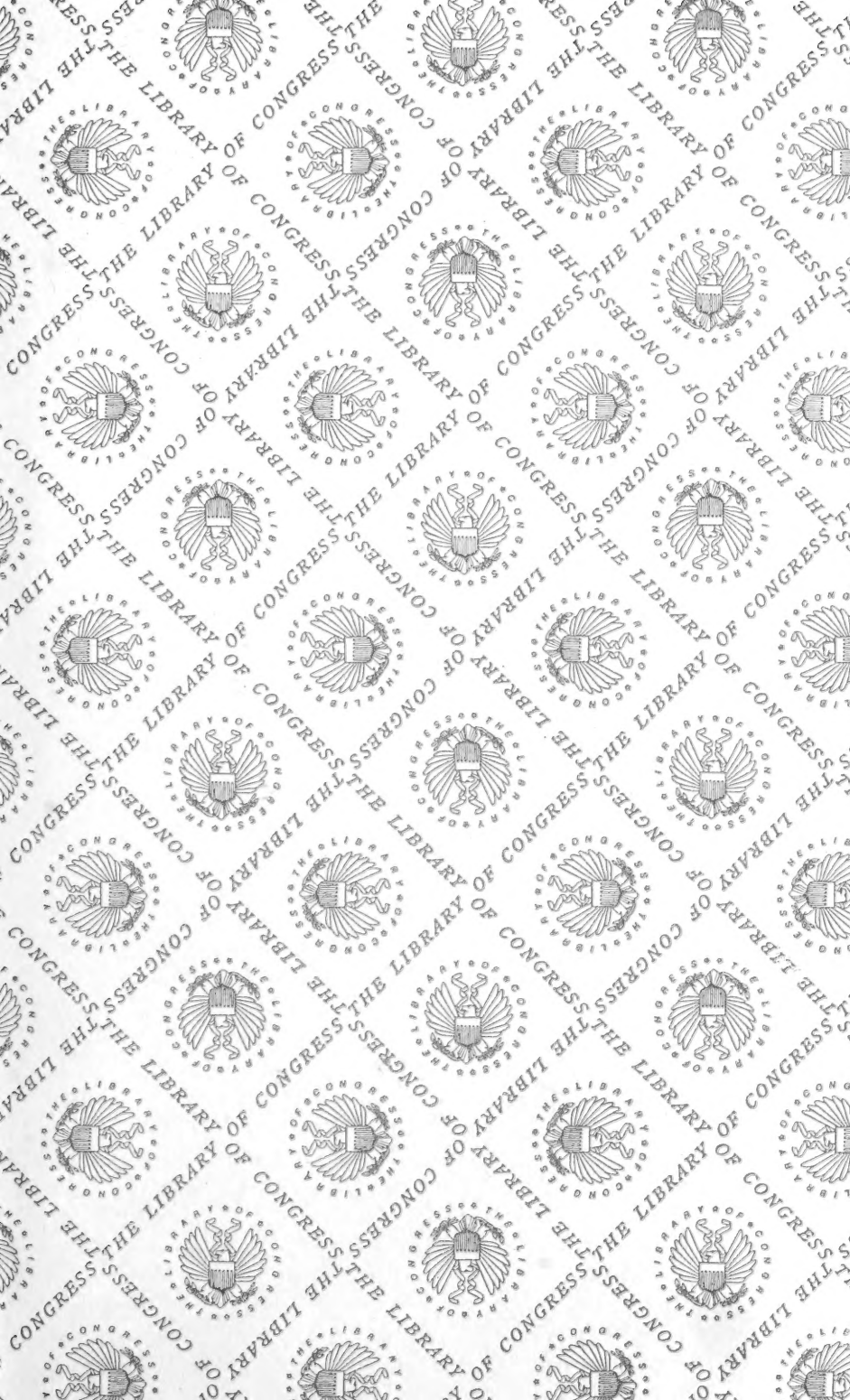


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VOLUME XVI

MARCH, 1916

No. 8

BULLETIN 5703)
OF

The New York State College of Forestry

AT

Syracuse University

A STREET TREE SYSTEM FOR NEW YORK CITY

BOROUGH OF MANHATTAN

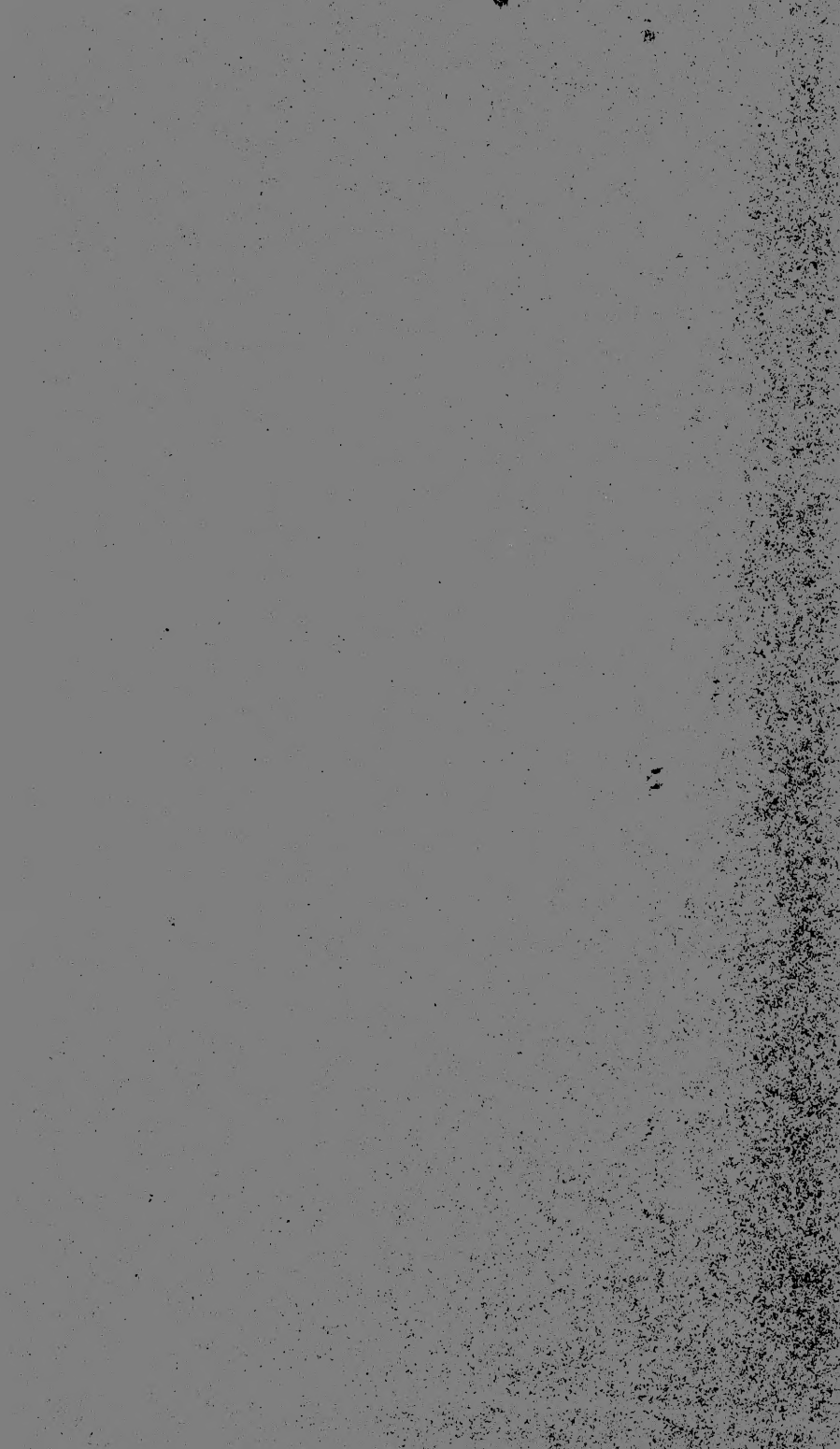


Report to Honorable Cabot Ward, Commissioner of Parks, Boroughs of Manhattan and Richmond, New York City. By Laurie Davidson Cox, Assistant Professor of Landscape Engineering, The New York State College of Forestry, with an introduction by Dr. Hugh P. Baker, Dean of The New York State College of Forestry

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Monograph



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Photograph by L. D. Cox.

LOWER FIFTH AVENUE.

The charm of street trees on a busy thoroughfare. One of the few examples in Manhattan which recall the tree-lined business streets of London and Paris.

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A REPORT TO HON. CABOT WARD

Park Commissioner
Boroughs of Manhattan and Richmond
New York City

BY

LAURIE DAVIDSON COX

Landscape Architect

Member American Society of Landscape Architects

Asst. Prof. Landscape Engineering

N. Y. State College of Forestry

FEBRUARY, 1916

Introductory Statement to Report Submitted by Professor
Laurie D. Cox of The New York State College of Forestry
at Syracuse University to Hon. Cabot Ward, Park Com-
missioner of New York City

By HUGH P. BAKER

The New York State College of Forestry at Syracuse University, which was established by legislative action in 1911, is obligated in its charter to carry on educational work in Forestry wherever that may be needed in the State equally with the training of young men at Syracuse. It therefore developed, early in 1912, its Extension Service in Forestry for the giving of illustrated lectures and demonstrations in forestry. As a part of the Extension Service it began in 1912 studies and practical demonstrations which would assist rural communities and cities in the beautification of highways, country roads, streets, parks and public grounds generally. This work was done both for the purpose of making the results of general educational value in the State and with the idea of using the trees about the homes of the people and along roadways and highways and in parks as the means of creating a better understanding by the people of the actual forestry needs of the State.

When early in 1914 the Tree Planting Association of New York City, of which Dr. Stephen Smith is president, asked the College what it could do in cooperating with the Association to find out the condition of trees and the extent and nature of tree planting in New York City and through this knowledge evolve a proper system of tree planting, the College stated at once that it would be glad to lend one of its landscape engineers during an entire summer season. The Tree Planting Association accepted the suggestion of the College and Professor Henry R. Francis, in charge of the

Landscape Extension Service of the College, was assigned and worked during the summer of 1914 upon a series of investigations of typical streets to show just what the condition of street trees was at that time with the idea that a knowledge of these conditions would lead people to appreciate very forcefully the necessity for more and better trees in New York City. Soon after the close of the season a bulletin was prepared by Professor Francis which was issued as Series XV, No. 1c, by The New York State College of Forestry and entitled "Report on the Street Trees of the City of New York." Copy of this report may be had upon application to the College.

In the spring of 1915, the President of the Park Board of New York City, Hon. Cabot Ward, who had followed with interest the investigations of Professor Francis, requested the State College of Forestry at Syracuse to detail one of its men for another season with the idea that the investigations of 1914 could be applied to somewhat more definite problems of caring for street trees and evolving a suggestive system of street planting and culture for the entire city.

Professor Francis having been assigned by the College to spend the season with the Massachusetts Forestry Association in carrying out field work on the 300-mile highway from Boston to the New York line and back through Cambridge to Boston, Professor Laurie D. Cox, a graduate landscape architect, was assigned for the work under Mr. Cabot Ward.

At the close of the summer of administrative and investigative work in the park department, Professor Cox submitted the following report which received from the President of the Park Board highly complimentary notice. As the College felt that it would be desirable to publish the report by Professor Cox that it might serve as an illustration of a scheme of tree planting for American cities, Mr. Cabot Ward very gladly released the report for publication and distribution by the College.

The College of Forestry feels that the work of Professor Francis and Professor Cox in New York City is in line with

its obligation to be of service to the people of the State. The College has under way investigations of several other communities of the State in some of which the tree survey is being done by the school children of the community. Out of this general educational work by the College and by other institutions and agencies, there is developing a widespread interest and knowledge of proper methods of planting and protection of street and park trees and it should all lead to making New York State a better place in which to live.

Letter of Transmittal

*To Honorable Cabot Ward, Park Commissioner, Boroughs of
Manhattan and Richmond:*

SIR.—I submit herewith the accompanying report concerning the street tree situation in Manhattan. This report embodies the results of my summer's investigation concerning the possibilities for successful tree growth on the streets of your borough.

It has been my aim to approach the problem in a somewhat new way, rather as a phase of city planning than as a mere horticultural problem in street tree growth. The attempt has been made to present thus a scheme for street tree control which may be appropriate in its ambition to the dignity of America's foremost city.

The success of my summer's work has been largely due to the generous cooperation of all the members of your department organization. They have placed at my disposal their knowledge of and experience with local conditions, without which it would have been very difficult to have accomplished much in the brief period of time at my disposal.

I wish especially to acknowledge the valuable assistance rendered me by your Secretary, Mr. Volentine, and the landscape architect of the Department, Mr. Pilat, and his assistant, Mr. Gattringer. I was also much aided in my study of the problem of tree planting zones by having access to the maps and records of the City Plan Commission through the courtesy of Mr. George B. Ford and his assistants of the City Planning Bureau.

Respectfully submitted,

LAURIE DAVIDSON COX,
Landscape Architect.

SYRACUSE, N. Y.

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Photograph by L. D. Cox.

A MANHATTAN RESIDENCE STREET.

Showing that it is possible to secure splendid tree planting even on the narrower residential streets of Manhattan. The trees are young Norway Maples. This picture illustrates that form of the normal type of planting design in which the trees "frame-in the vista" — here very valuable. If these trees are allowed to grow until they reach the "overarching" form, the beauty of the street will be much lessened.

I. Introduction

It will not be considered necessary in this report to discuss the many ways in which trees on city streets affect the health, the beauty and even the real estate values of the community. Everyone has heard of these things, everyone believes them and nearly everyone is willing to pay his share in securing them.

To the city dweller the street trees are peculiarly precious. Foremost among the features which surround his home or place of business they make real to him the changing seasons and serve to remind him of the open country which lies beyond the confines of his masonry and asphalt existence.

It is not surprising therefore the amount of interest which problems in connection with street tree growth have awakened during recent years not only in New York but in many cities, for there are few questions of municipal life upon which the average citizen is more unanimous in his opinion than in the desirability of shade trees on the streets of his city.

In spite of this interest, however, and the popular support of all movements in behalf of street trees the progress which has been made in the art and practice of growing trees upon the streets of our larger American cities has been largely negative. This is mainly because the street tree problem on account of its apparent simplicity has not received the amount of serious attention from experts which it has demanded.

Our city planners and landscape architects have for the most part been engrossed with more adventurous problems and our city foresters save in a few cases have given their attention to the simpler horticultural and entomological problems of planting and care, rather than the more important features of design, engineering and administration.

In any sizable city successful street tree growth is a difficult matter, and one demanding the expenditure of money and the advice of experts. In New York the growing of street trees is much more difficult and more costly than in most cities and so far it has been correspondingly less successful.

To secure again on the Island of Manhattan the tree shaded thoroughfares once among the city's most cherished possessions and now so rapidly passing away, is still possible. To accomplish this but three things are necessary: money, knowledge and a definite and comprehensive scheme or program. The first should be secured without difficulty, the second is made possible by the first, and this rather brief and far from perfect report will endeavor to suggest the third.

II. The Street Tree Problem in Manhattan

Any hasty consideration of the question of growing street trees in New York City, or in that most typical portion of it, the Borough of Manhattan, will develop one of two opinions. Either it will be deemed a simple problem such as is being solved in nearly every town or city of the land or it will be declared a matter utterly absurd—a problem impossible of solution.

Like the results of most hasty considerations, neither of these opinions is correct. Successful tree growth on Manhattan streets is something considerably more than a question of ordinary planting and care. Again it is neither impossible nor impracticable to secure on many streets a satisfactory growth of shade trees. It is true, however, that to secure any considerable number of permanent shade trees on the streets of Manhattan is a problem which is without question one of the most difficult ones yet approached by city foresters or park authorities in this country.

In addition to the ordinary difficulties which beset tree growth under city conditions, such as pavements which shut out water and air from the roots; trunk injury due to heavy traffic; weakened vigor to resist insects and disease, due to gas-poisoned soil and smoke and dust-burdened air; we have in Manhattan many additional hazards to overcome. Thus above ground, the very general presence of high buildings upon comparatively narrow streets causes a very serious lack of sunshine, light and air and produces a prevalence of tearing, swirling winds. Below the surface we have even more abnormal conditions in the extensive use of the area beneath the street for subways, sewers, conduits and vaults. These things are true not only of the business streets but of the residential streets as well. The grass parking strips between sidewalk and curb which are present on the majority of the

residence streets in other cities are an extreme rarity in Manhattan. An open area of lawn or yard between the building and the sidewalk is still rarer and practically does not exist throughout 95 per cent. of the borough. In fact the growing conditions on the average residence street in Manhattan are no better than, and often not as good as those of the business street in the ordinary American city.

As a result of all these factors the problem of growing trees on the majority of Manhattan streets becomes a totally artificial one. The entire soil to contain the roots, together with all food, air and water for the tree, must be supplied artificially, much as they are supplied to house plants or to trees grown in conservatories. That is, the tree must be grown in a tree pit of prepared soil much as a plant is grown in a flower pot. In some cases this pit must be provided with concrete walls and underdrainage, while very commonly iron gratings or some form of protecting cover must be installed over the surface of the pit.

The entire problem of selecting the tree, its planting, pruning and care must thus be radically different from those of ordinary street tree practice, and likewise the cost must be considerably larger than that for planting and maintenance in the average city or town. In certain boroughs of New York City it has been estimated that a tree may be successfully planted and cared for until established for eight dollars, whereas a sidewalk grating alone on a Manhattan street will cost several times this sum. In the City of Newark a tree can be planted and established for approximately five dollars, while in Manhattan it will cost nearly this amount to cut and remove the pavement above the pit in which the tree is to be planted.

If any plan or program for street tree planting in Manhattan is to be made it is very evident that a careful study must be given to determine the following facts:

(1) *On what streets shall trees be planted?* (The high cost as above explained makes it impracticable to attempt to plant the entire borough, and likewise the present and future

use and condition of many streets makes successful planting upon them impracticable if not impossible.)

(2) *What kind, type and size of trees can be used with assurance of success under the peculiar, adverse conditions which prevail?*

(3) *What will it cost to do the work on the different classes of streets?* (Since the conditions of the streets differ so widely, no uniform system of planting can be used which will be most efficient and economical in all cases. Different types of planting must be determined upon for the different conditions which are to be met.)

(4) *What form of organization will be necessary for securing and maintaining satisfactory street tree growth according to these determined facts?*

(5) *What is a reasonable budget for the organization and program thus determined upon?*

We will attempt to consider each of these points in order.



Photograph by L. D. Cox.

THE PIN OAK USED AS A SMALL FORMAL STREET TREE FOR POOR GROWING CONDITIONS.

A view of north Broadway showing the existing planting of a rather interesting type; a double row of Pin Oaks in a central parking. If these trees are to be maintained successfully they should be kept as at present of small size and formal shape since the few feet of soil above the subway roof will not permit a root system sufficient for large trees. To permit a greater use of the central parkings they could be kept in alternate blocks of grass and gravel, the gravel blocks to be provided with concrete seats. The existing planting should be extended south to 135th Street. A lighter guard would be more attractive and give ample protection. See Chapter IV for other planting types.

III. A Street Tree System

What Streets to Plant

In any serious consideration of street tree planting in Manhattan it is evident that not all streets are equally available or advisable for this purpose. Narrow sidewalks, excessive congestion, commercial traffic, high buildings, underground construction, all of these together or in various combinations eliminate many streets from the list of those practicable or possible for satisfactory tree growth.

On account of this fact it may appear perhaps that any tree growth, even if it is secured, must be scattered and haphazard, and that no continuity can be had. Again, owing to the high cost of planting under the existing conditions, and with the rapid deterioration of the existing trees, the task of securing permanent street tree planting in Manhattan may indeed seem hopeless in its immensity.

It would certainly appear that if any worth-while results are to be obtained we must have a plan or program towards which to work, that is, an organized system or selection of streets upon which to concentrate our efforts.

To select these streets and then coordinate them into an organic scheme of city decoration has suggested to the writer the idea of a street tree system, and what is more natural than to unite this system in some way with the city park areas which, with the street trees, supply the horticultural decoration of the city.

In this way the idea of a street tree system as a scheme of inter-park connections had its origin.

One of the important city planning features in most modern American cities is the park system, and there are few progressive cities of today which do not have such a system under construction or cherish ambitious plans for such a consummation. In fact this scheme of organizing the various park units into a correlated whole and connecting them by

parkways and boulevards into a comprehensive system has been termed "the one great contribution of America to the modern art of city planning."

New York City, although the pioneer among American cities in the creation of public parks and the possessor of some of the most magnificent individual park areas in the land, alone among the great cities of America possesses neither a park system nor a definite plan or program for the creation of such a system.

In the other boroughs of the city, save Manhattan, the opportunity exists for working out a park system with the usual park connections and doubtless all of these boroughs will some day possess, in greater or less degree, such systems. In Manhattan, however, due to the intensive use of all available real estate, a park system by means of these ordinary forms of park connections would appear to be practically impossible. If a system of connecting ways is to be secured in Manhattan at any reasonable outlay, we must make use in some form of the existing streets.

With this thought in mind in approaching the street tree problem, the writer was impressed with the feasibility of securing a system of park connections in Manhattan by means of a comprehensive and organized system of tree planting on carefully selected streets. By selecting streets which will permit of successful tree growth and by securing in our planting design a reasonable degree of interest and individuality, a park system unique among American cities may be secured. Such a scheme of street planting would not only coordinate the existing scattered park areas of the borough into a comprehensive system, but would also impart that peculiar or individual character and beauty which is necessary if Manhattan, the heart of New York City, is to take its place, as its importance in all other lines justify, among the beautiful cities of the world.

A careful study has been made of every street in Manhattan leading to or from the various park areas. It has been found possible in the case of practically all of the more important parks to select streets suitable for inter-park con-

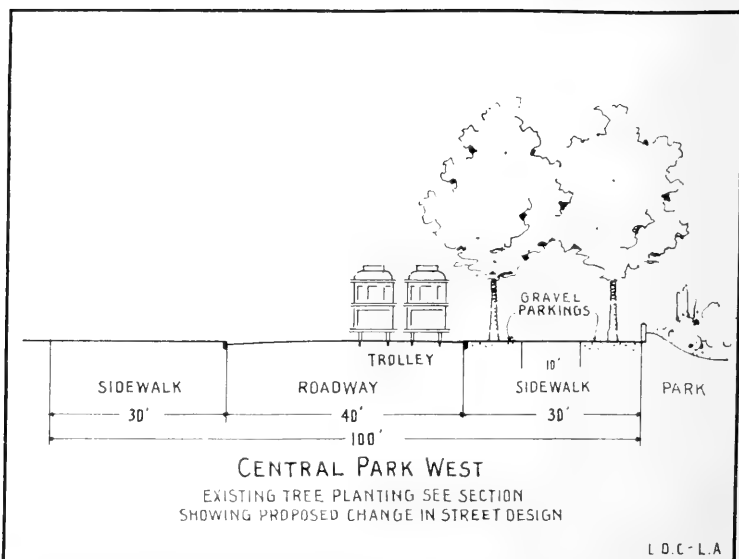
nections upon which successful tree growth of one form or another may be secured. These streets are suggested for our proposed "*street tree system*," and are shown upon the accompanying map.* By concentrating our efforts upon these streets it will be possible, with a reasonable annual expenditure, to secure a condition of tree planting in Manhattan which will give to the city the appearance and charm of a tree-shaded city.

In selecting the streets to be used, careful consideration was given not only to the existing conditions of the streets in question, but also to the future development of them. This latter was largely determined by the proposed scheme of districting being worked out by the City Planning Commission. The streets of our proposed street tree system are confined almost entirely to those streets which lie in the districts limited to residential or restricted business (retail stores, offices, etc.) and residential purposes.

Several streets which it would be very desirable to include in our system, and whose present condition would permit of tree growth have not been so included because they lie within the proposed unrestricted districts (factories, warehouses, etc.), where the ultimate development would probably render tree growth either impossible or at least unsuccessful. These few streets are indicated separately upon our map, and if by any chance the proposed districts could be slightly changed so as to exclude these streets from the unrestricted districts they should be added to the system.

There are of course other streets not included in our system of inter-park connections, but upon which trees may be grown successfully. These are streets which will lie in the restricted residential districts. They, too, are indicated upon the accompanying map.* The program should be to encourage tree planting by private owners upon these streets according to the block unit discussed in Chapter V, and public planting should be carried out upon these streets after the main system has been completed.

* See large map of The Street Tree System.

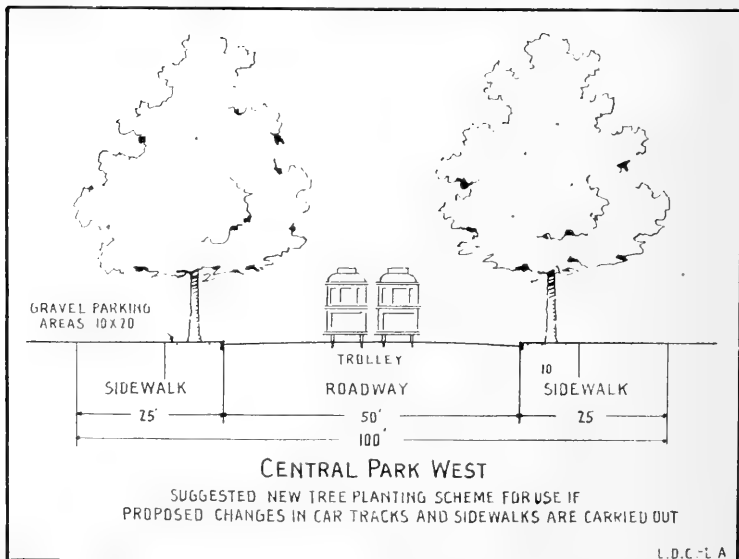


PLANTING OF THE "NORMAL" TYPE IN THE UNBALANCED FORM.

A typical section indicating the existing condition of this street.

It is proposed to widen the roadway to relieve traffic congestion; see sketch below.

If the present design is retained, a third row of trees grown beneath gratings could be located on the sidewalk to the west. The present trees cannot be counted upon for long and will soon have to be replaced.



PLANTING OF THE "NORMAL" TYPE (FORM B OR C).

Planting of the normal type would be appropriate for this street if the contemplated change in the street design is carried out. The Oriental Plane or Linden could be used, and grown either in fenced (grass or gravel) parking areas or in tree pits with grating or brick-paved surface.

IV. Planting Types

Design in Street Tree Planting

In any program or system of street planting it is unwise to adopt any single type and attempt to repeat it on all streets. Not only do variations in conditions make such a scheme unscientific, but all interest and variety in the system is lost, and in spite of the great beauty of individual streets the general effect will become somewhat monotonous.* This is especially true if we seek to form a unified and comprehensive system, to serve as inter-park connections, such as we have suggested.

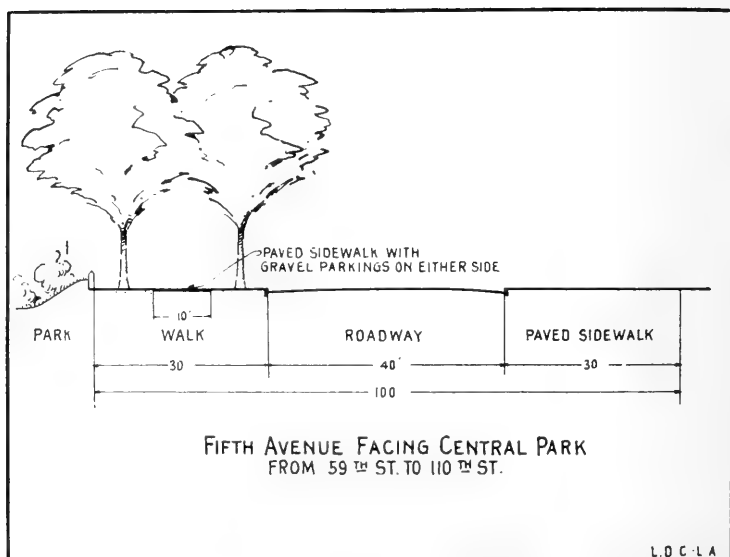
It is of course impossible to secure a different type of planting for each particular street, yet in the more important cases this can be done or at least a single type can be so varied by using different species of trees as to give a distinct character to each of the more important individual streets and avenues. A few of the various types of planting design which are possible and appropriate in Manhattan are illustrated by the accompanying sketches. These sketches in the form of street sections show these suggested types of planting as recommended for some of the more important thoroughfares of our proposed system.

While the forms of planting which it is possible to secure permit of great variation, there are several readily distinguished types which are particularly appropriate for Manhattan streets.

I. *The Normal Type.*

The simplest form of street tree planting is that in which we have a single or double row of trees on one or both side-

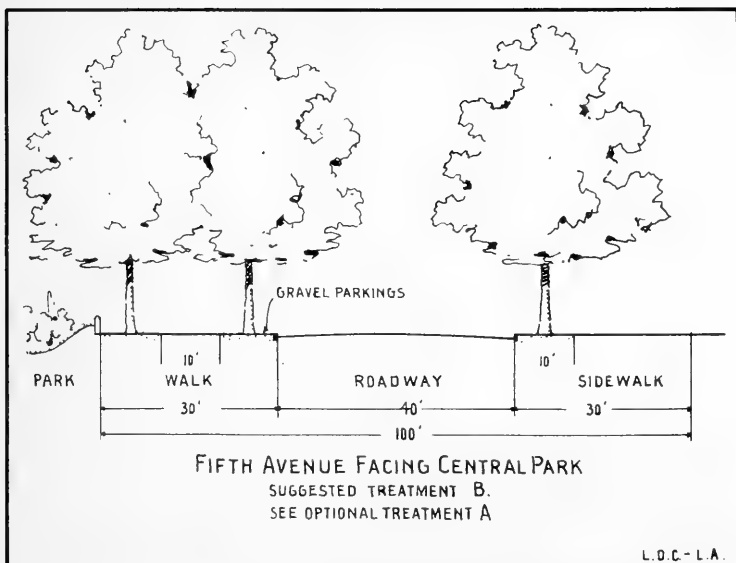
* Several American cities with excellent street tree planting suffer from monotony due to uniformity of planting design and the use of the same species of tree on the majority of the thoroughfares.



PLANTING OF THE "NORMAL" TYPE IN THE UNBALANCED FORM.

A typical section illustrating the existing tree planting in this street.

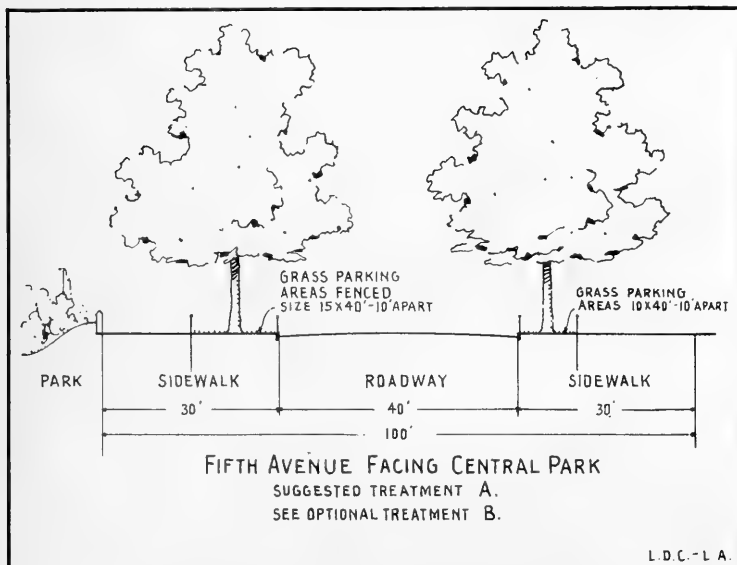
The present trees, American Elms, cannot be counted upon for long, as conditions are unfavorable for their growth and they are fast deteriorating. They could be replaced by Oriental Planes or Lindens. In replacing, one of several types of planting may be had: the present form with a double row of trees on one side or either of the two forms illustrated in the following sketches.



PLANTING OF THE "NORMAL" TYPE WITH DOUBLE ROW ON ONE SIDE.

A suggested type for new tree planting on Fifth Avenue facing Central Park. This provides for three rows of trees in continuous gravel parkings.

In planting the double row on the west it would be well to alternate the spacing in the two rows with the trees at 50-foot intervals in each row.



PLANTING OF THE NORMAL TYPE (FORM B).

An optional type of planting for Fifth Avenue facing Central Park; normal type planting.

This scheme of planting provides for the trees being grown in large tree pits or parking areas, to be kept in grass and fenced.

The tree recommended for this street is either the Oriental Plane or the Linden.

walks (balanced or unbalanced form), and this being the one in most common use we may call it the standard or normal type. Two distinct effects may be secured in this form of planting depending on the nature of the trees used—whether the trees are (a) of broad spreading habit or (b) of upright pyramidal or columnar habit.

In the one case we get an over-arching effect such as is seen in so many streets which contain old American elms. With trees of the upright form such as is found in the younger stages of growth with practically all trees, or with mature trees such as the pin oak or gingko, we get the effect of a framed-in vista especially pleasing when an interesting building, monument or view terminates the vista.

The over-arching form, while beautiful in itself, is seldom satisfactory save on streets with very wide grass parkings which will meet the conditions of growth which the roots of large trees demand. It is the absence of such parkings that is causing the rapid passing of the American elm as a street tree in New York City.

In street planting of the normal type the trees may be grown in several ways, depending upon the design, width and traffic conditions of the street in question.

(A) In grass or gravel parkings.*

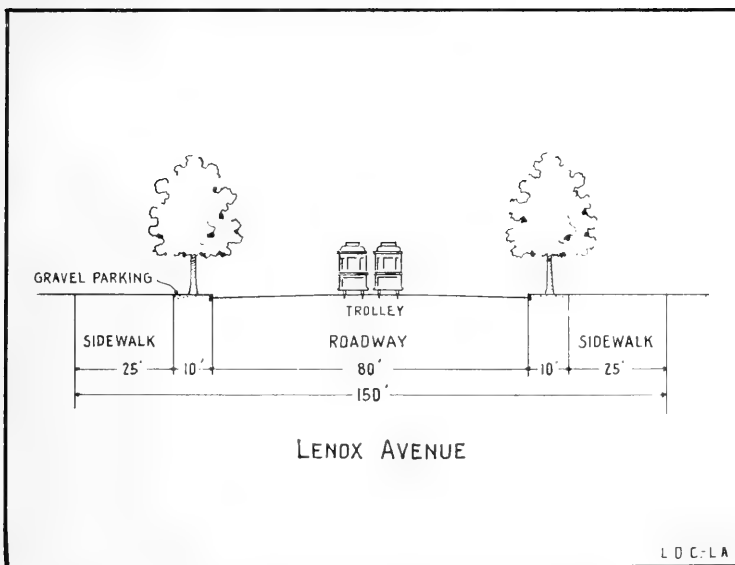
(B) In fenced parking areas or large tree pits.

(C) In small tree pits with gravel surface or with iron grating or other form of surface cover.

(D) In a continuous strip, between sidewalk and curb, which is paved with bricks laid in sand.

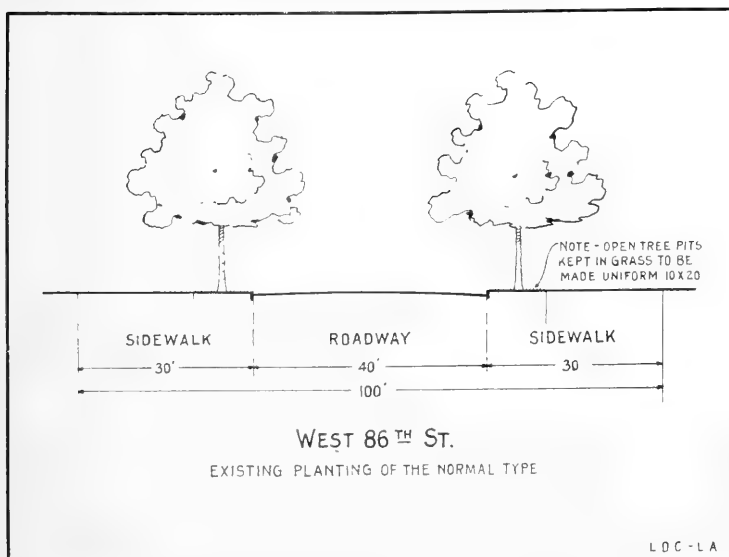
This type of planting is adapted for use on residential or secondary business streets which have wide sidewalks and

* In the case of grass parkings, where the parkings are sufficiently wide, shrubs may be planted in rows or clumps between the trees. Very beautiful effects may be secured by using a single variety of shrub on a street in combination with a single variety of tree. Thus great individuality may be given to different streets and yet use only the normal type of planting design. The city of Sacramento, Cal., has adopted a street planting program along this line and the writer assisted some years ago in making the selection of trees and shrubs for the first street so treated.



PLANTING OF THE "NORMAL TYPE" (FORM A).

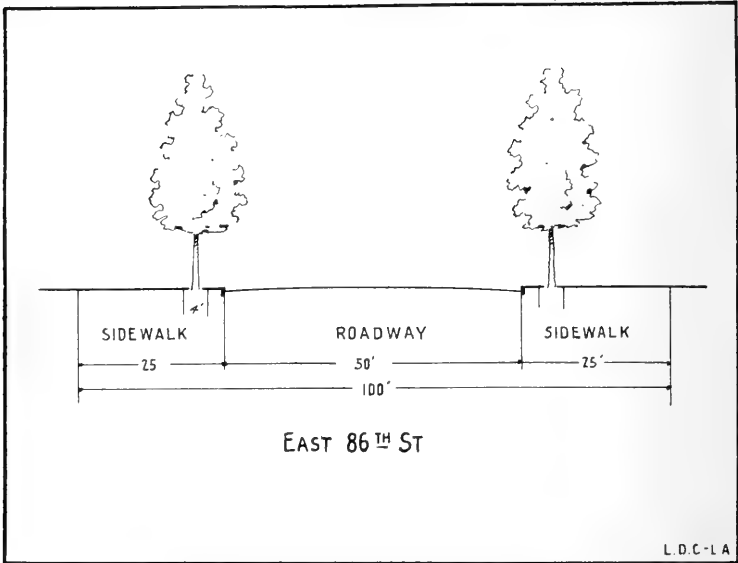
A section showing the proposed treatment for this street. New planting of young trees on continuous gravel parkings, to replace the fast disappearing American Elms. Any one of the following trees are suggested for this street: Oriental Plane, Linden, Gingko, Norway Maple, or Pin Oak.



PLANTING OF THE "NORMAL" TYPE (FORM B).

Planting existing on West 86th Street.

The trees are planted on grass parking areas which are fenced for protection. The existing trees are too closely planted. (See photograph on page 47.)



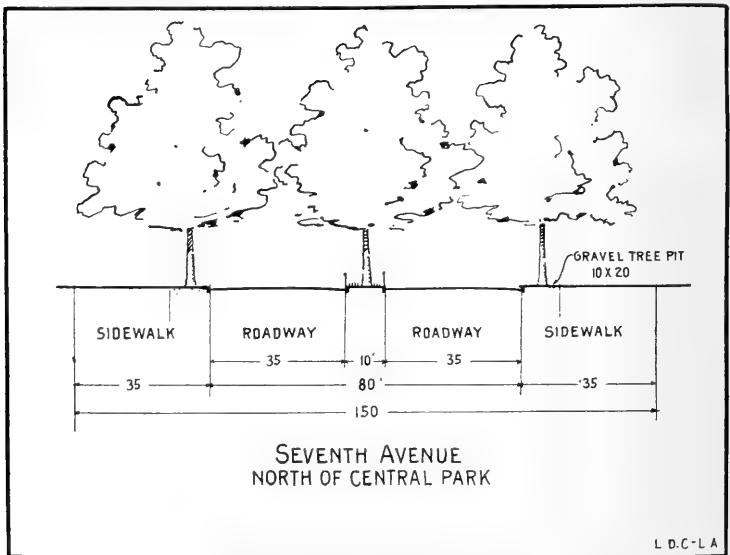
PLANTING OF THE "NORMAL" TYPE (FORM C).

A suggested method of treating 100-foot streets which contain narrow sidewalks with broad roadways and which are not provided with car lines.

By a slight reduction in the roadway width the sidewalks may be widened from 20 to 25 feet. Trees of tall, narrow form should be used to prevent cutting off the supply of light and air from the lower stories of the houses. The Ginkgo and Pin Oak normally grow in this form, and can easily be kept of the shape and size desired by pruning.

Trees to be grown in tree pits with iron gratings or other form of surface covering.

See Section of East 106th Street for an optional treatment for streets of this class.



PLANTING OF THE "THIRD ROW" TYPE.

Typical section showing a suitable treatment for this street. It is advised to replace the present rapidly deteriorating Elms on the sidewalks with Oriental Planes such as exist at present in the central parking.

The side rows could be kept pruned to small or medium-sized trees if the business development of the street demands it. Probably owing to the limited area available for the roots of the central row such pruning would be beneficial to the trees in this row also.

hence have room for the proper development of fair sized trees. Considerable variety may be secured with this single type by using different species of trees upon the different streets. Probably 95 per cent. of the street tree planting in this country is of this type and nearly all Manhattan streets in which street tree planting is possible may be treated in this way if desired. However, on many of the streets of our proposed system other forms of planting will be more appropriate. Typical streets for which this type of planting is suggested are:

West 86th street (largely existing).

Lenox avenue.

Central Park West.

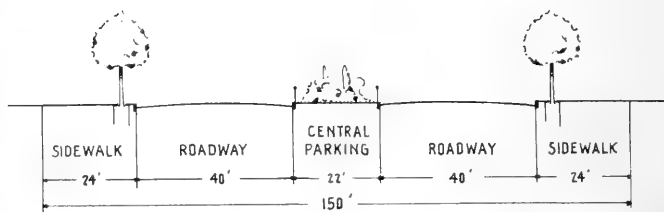
Fifth avenue (59th to 110th street).

II. *The Third Row Type.*

A similar type of planting is that in which in addition to the single or double row of trees on either sidewalk a third row is added in the center of the street. This third row is normally grown in a wide grass or gravel parking or in a narrow parking area preferably fenced. This type of planting is adapted for use on wide streets which do not contain central car tracks. A typical Manhattan street adapted for this form is Seventh avenue, north of Central Park, where the central planting has already been made. In planting of this type the third or middle row may consist of a single or double line of trees depending upon the width of the center parking. (See type V.)

III. *The Center Parking Type.*

Another type of planting which differs but slightly from the above is that in which the central parking is planted to flowers or shrubs instead of trees. This form has been much used in suburban real estate development in many cities and when the street is sufficiently wide and the work is well done produces probably the most attractive form of residential street obtainable. The lateral rows of trees may either be allowed to attain a large size, or, if the proper varieties are used they may be kept to a low formal shape by pruning.



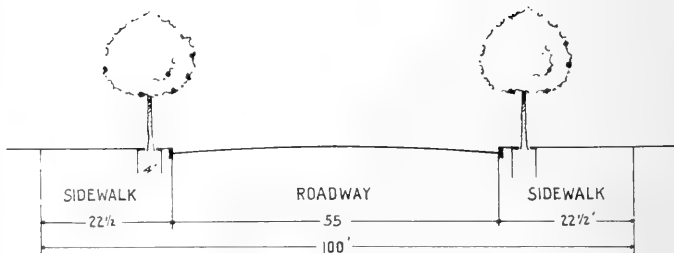
BROADWAY
59TH ST. TO 122ND ST.

L.D.C.-L.A.

PLANTING OF THE "CENTER PARKING" TYPE.

A unique and distinctive form of this well known type of planting which is suggested for Broadway from 59th Street to 122nd Street.

The shrub planting on the central parking already exists. The scattered and deteriorating Elms on the sidewalks should be replaced by small, formally pruned trees. Poplars or Ginkgos are recommended for this purpose. Planes or Lindens could be used with the same pruning, but are not quite so adaptable to such severe treatment.



FIFTH AVENUE BELOW 59TH ST

L.D.C.-L.A.

PLANTING OF THE "PRUNED FORMAL" TYPE.

A beautiful and distinct form of planting appropriate for this important business and residential street.

This type of planting on a small scale, using Poplars, has already been tried in New York and in Newark. The trees are to be kept of small size and formal shape by pruning, and they are to be grown in specially prepared tree pits beneath gratings. Either the Poplar or Ginkgo is recommended for this use. Small trees of this form would remove the prejudice of shop owners to trees in front of their places of business.

See Chapter VI for details and photograph of this type of planting.

On streets where the buildings are high and extend to the property line, and where the street has a large business development, this latter type of tree will be found more beautiful as well as more satisfactory. This formal type is suggested as being especially appropriate for Broadway from 59th to 122nd street. Here the central parking treatment already exists and the rapidly dying sidewalk trees need replacing.

IV. *The Pruned Formal Type.*

The same kind of trees mentioned above, that is, trees pruned to a low size and formal shape, may be used for planting on business streets as ordinary sidewalk trees. This form of planting might be considered a variation of the normal type (Number I above) but is so distinctive and unusual that I have classed it as a distinct type. Although little used as yet in American cities this form of planting has long been used abroad and has repeatedly been recommended by city planners and landscape architects. This type is adapted for use on high class business streets or combined residential and business streets where sidewalks are narrow and growing conditions generally poor, but where the decorative effect of tree growth is highly desirable. The advantages, both esthetic and practical, of this type of planting for use on streets of this nature are many. The formal appearing trees lend an added dignity to the architecture of the street, which is especially appropriate on a highly developed thoroughfare such, for instance, as Fifth Avenue. The small-sized trees may be kept in good condition even when grown in a restrictive soil area in which large trees would rapidly deteriorate or die. When breaks occur in the tree lines due to individual mortality these breaks can be readily filled by planting new trees of fair size which, within a year or two, will acquire in everything, save diameter of stem, the size of the existing trees. Fair sized trees should be grown in a municipal nursery for replacels of this kind. It is doubtful if there is any city in the country in which this type of planting would be more appropriate or more valuable than in New York.

Typical Manhattan streets suggested for this treatment are:

Fifth avenue below 59th street.

West 23rd street.

Fifty-seventh street.

Tenth avenue (57th to 72nd streets).

West 11th street.

East 36th street.

Second avenue (7th to 15th street).

V. The Center Row Type.

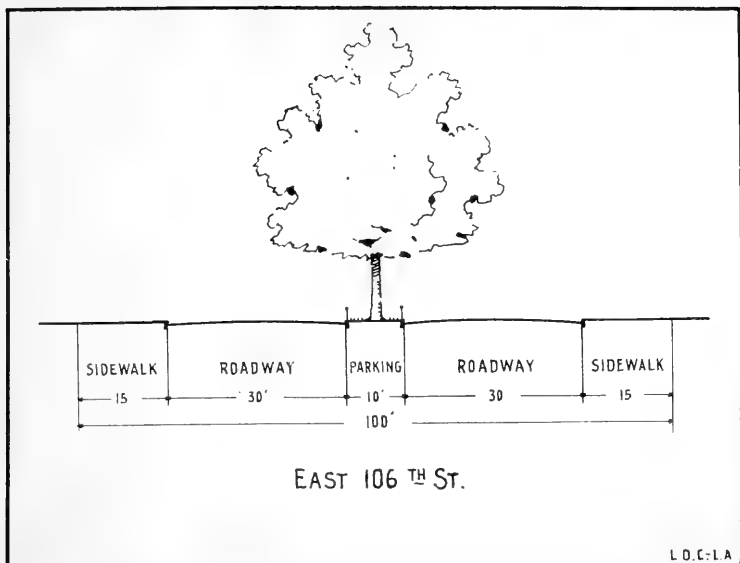
Another interesting type of planting is that which makes use of a single or a double row of trees in a central parking without the ordinary sidewalk trees. This type might be considered a variation of the "Third Row Type" (Number II above). It is an optional type of planting for use on wide streets where the normal type (Number I) could also be used. It is especially appropriate for streets with narrow sidewalks and wide roadways, since it will give shade and arborial decoration to a street, and yet cut off no light or air from the lower stories of the buildings. It is thus well adapted for wide streets which contain high buildings and congested population. Typical streets for which this type of planting is appropriate are:

(a) (Single row) East 106th street.

(b) (Double row) Broadway, 135th to 168th street (partly existing), Delancy street (existing).

VI. The Informal Type.

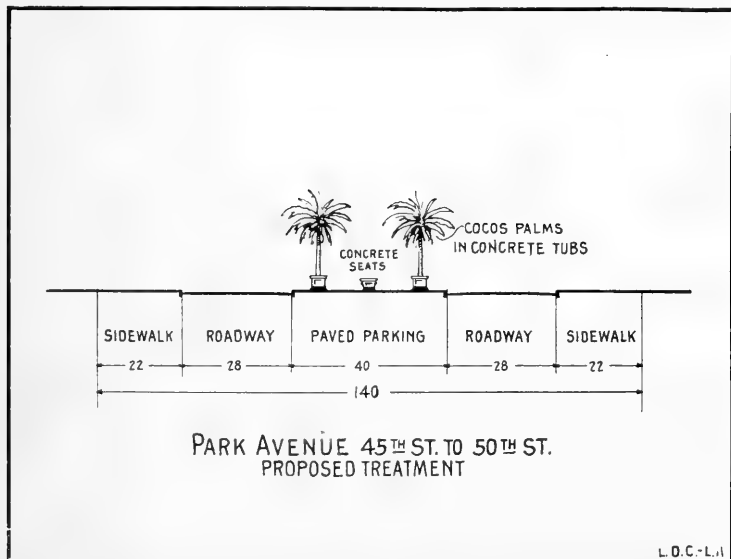
A more unusual type of planting is that in which a central parking is planted to shrubs and informal groups of trees, but in which no regular rows of trees occur on either the central parking or the sidewalks. This style of planting is used entirely for decorative effect upon the street with no thought of shade. This type is appropriate for wide streets with high buildings where other types may not be used on account of shallow soil conditions due to subways or other forms of construction beneath the street. Park avenue from 50th to 96th street is already very effectively



PLANTING OF THE "CENTER ROW" TYPE.

A suggested type of planting for 100-foot streets which contain narrow sidewalks with broad roadways and are without car lines.

In this case the sidewalks are narrowed from 20 to 15 feet, and a central parking 10 feet wide (as in Seventh Avenue) is constructed. Either this treatment, or that suggested for East 86th Street, is recommended on 100-foot streets with 20-foot sidewalks, as such sidewalks are too narrow for satisfactory tree growth, or if the ordinary type of tree planting is attempted the lower stories of the buildings are rendered unhealthfully sunless.



PLANTING OF THE "POTTED TREE" TYPE.

A suggested treatment for the paved central plots or parkings in Park Avenue.

Since this street is merely a roof to the railroad yard beneath no permanent planting is possible. Trees of distinctive appearance are suggested, grown in concrete pots.

This unique treatment would not be extremely costly, and would form a splendid approach to the Grand Central Station from the Parked section of this street. Cocos Palms are suggested for summer use which would be stored in Winter and replaced by Evergreens, likewise grown in pots.

treated in this way. On the upper portion of this street rows of sidewalk trees could be secured if desired, as in type Number III.

VII. *The Potted Tree Type.*

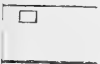
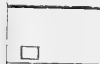
A rather rare and even more unusual form of street planting is that which makes use of trees or shrubs grown in large pots or tubs, the trees so grown being placed either on a central paved parking or on the sidewalks.* This style of treatment is productive of great beauty when used on a high class thoroughfare,† and is well worth while on important avenues where natural tree growth is impossible. This type is suggested for Park avenue from 45th to 50th streets where wide, brick-paved central parkings already exist, and where the street forms the approach to the Grand Central Station. This street with its attractive architecture and the splendid vista termination formed by the station is destined to become a very beautiful and very famous thoroughfare, and the city would be justified in spending considerable money in its horticultural decoration.

VIII. *The Parkway Type.*

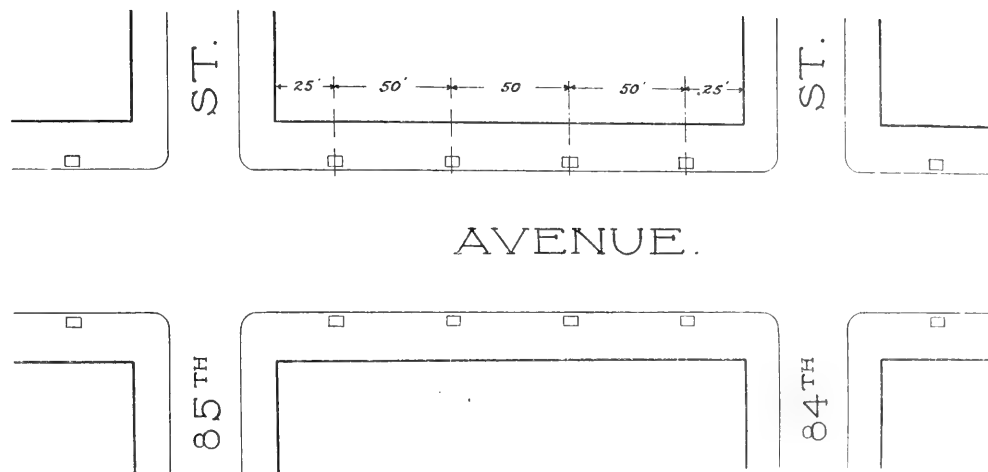
Probably the most unusual type of street tree planting is that which makes use of an informal grouping of trees of one or more varieties upon lateral grass parkings with or without informally planted center parkings. This is merely adapting to formal streets the type of planting now used on informal parkways. The value of such a type of planting is purely one of taste and, although somewhat daring, is advocated by some authorities. There appear to be no streets in Manhattan which would lend themselves to this form of treatment.

* Some heat-resisting tree of striking foliage such as the Palm (species suggested *Cocos plumosa* or *Chamerops excelsa*) could be used for summer use to be replaced in winter with evergreens (species suggested varieties of *Thuja occidentalis*, *Thuja orientalis* or *Juniperus Virginiana*). The former would be stored in an "orangery" in winter while the latter would be rested in a suburban nursery during the summer.

† This type of planting has been used very effectively on certain of the Boulevards of Paris, such as the Rue de Rivoli.



L. D. Cox, L. A.



SUGGESTED PLAN SHOWING
TYPICAL PLANTING ARRANGEMENT OF
NORTH AND SOUTH STREETS.

V. Spacing and Arrangement

Standardized Planting Plans for Typical Manhattan Blocks

So much has been said and written about the evils of planting street trees too closely that it may seem almost unnecessary to mention it again. There is nothing more difficult to secure in street planting than correct spacing and arrangement and this is especially true if the wishes or opinions of the abutting property owners are considered. The chief reason for this is that young trees are so small at the time of planting that when spaced as is commonly done from 20 to 30 feet apart they give no idea of the ultimate crowding which will occur when the trees reach maturity.

In addition to the injury to the appearance of the street as well as to the trees themselves when planted so thickly that normal development is prohibited when the trees mature, such planting becomes a serious menace to health, as it cuts off very largely from the lower stories of the buildings a proper supply of sunlight and air. In Manhattan where the buildings present a continuous facade on practically all streets this question of air and sunlight is of special importance, and crowded planting is especially unwise.

Besides these considerations of appearance and health the question of cost is also to be noted. With the high cost of planting and maintaining trees under Manhattan conditions the greatest efficiency will be secured by the widest spacing which it is possible to have, and still secure a satisfactory appearance. To secure such efficiency a uniform or standardized spacing is of course necessary.

The beauty of any formal type of street tree planting depends very largely upon regularity in the size, kind and arrangement of the trees, all of which are impossible unless a systematic scheme of planting is followed. The planting of trees by individual property owners,

so often done in other cities and much advocated in New York, always produces a condition where the trees are of varying size, age and kind, spaced at irregular and unsatisfactory intervals. The street trees form the most important and often the only esthetic element in street design, and it is difficult to see any reason for releasing them from the oversight of the city which controls and standardizes the rest of the street design. In some cities the tree planting is carried out as a part of the street improvement and this is fortunately the growing tendency. In fact it is no more reasonable to allow the property owner to show his individual preference regarding the kind or arrangement of street trees in front of his property than it is to allow him a similar privilege in the construction of his sidewalk or pavement.

The smallest unit area of a street that should be planted at one time in Manhattan is a block on the east and west streets, and two or more blocks on the avenues running north and south. The trees for this unit should be of uniform size and kind, and regularly spaced according to the size of the block as regards arrangement. It is of course much better to plant an entire street at once, but units of the size mentioned will permit of a reasonable degree of uniformity in the street planting in the borough.

The accompanying typical planting plans have been made to illustrate a satisfactory spacing arrangement for Manhattan streets. These plans show a minimum spacing distance of 50 feet, which will be found neither too small for the largest trees, such as the Planes, nor too great for the smaller formally pruned-trees, such as the Poplar and Gingko. This plan will give eight trees to the block on the avenues running north and south where the blocks average about 200 feet, and from 24 to 32 trees to the block on the east and west streets according as the blocks vary from 600 to 800 feet. The same standard of spacing should be used on any streets which do not divide themselves regularly into blocks. While it would be possible in some cases to plant the trees at smaller intervals, a very satisfactory appearance will be secured at 50 feet intervals. In no cases will there be serious crowding,

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TENTH

NINTH

SUGGESTED PLAN SHOWING
TYPICAL PLANTING ARRANGEMENT OF
EAST AND WEST STREETS.

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and the number of trees will be reduced to a minimum, a very desirable feature in consideration of the high cost of planting and maintenance in this city.

It is highly desirable to keep the corner trees from 40 to 50 feet back from the sidewalk curb at the street intersections so as to permit an auto-bus to load and discharge passengers at the street corners. The use of these conveyances is already an important feature of street transportation in Manhattan and the indications point to a still further extension of this service in the future.



Photograph by L. D. Cox.

Planted with heavy guard and grating as described in
Planting Specification No. 5.



Photograph by L. D. Cox.

Planted in central grass parking, fenced, similar to require-
ments of Planting Specification No. 1.

THE ORIENTAL PLANE AS A STREET TREE.

Two examples of the Plane on Manhattan streets.

VI. What Trees to Plant

A Description of the Varieties Best Adapted for Manhattan Streets

Having selected the streets upon which tree planting may be done with a fair prospect of success, the kind of tree and the way to plant it must next be determined. While the failure and death of trees upon Manhattan streets is very often due to unsuitable growing conditions which may be remedied by proper attention and care, there are certain trees which even under the best conditions obtainable are foredoomed to failure and should not be used. The number of trees suitable for street use in any city is small, and those which can be used in Manhattan with any reasonable expectation of success is still smaller. Under the most favorable conditions which exist in New York, such as on parkways or on streets and avenues having broad parkings, there is a fair range of choice; but in the main, the most satisfactory results will be obtained by restricting our list of trees to six or seven species.

After having considered carefully the city's past experience with tree growth in its streets and parks, the peculiar factors which enter into local conditions, and the experience of other cities, the following list has been prepared. This list comprises only those trees which can be grown with a reasonable assurance of success on the streets and avenues of Manhattan.

This list is arranged in order of quality considered in relation to the ability to succeed under the local adverse conditions:

(1) *PLATANUS ORIENTALIS* (*The Oriental or London Plane*); also known as *Button Ball* or *Sycamore*.

This tree is well known and already much used in this city. It is one of the hardiest and most adaptable of trees for use



Photograph by L. D. Cox.

THE GINKGO AS A STREET TREE.

An example of the remarkable hardihood of this tree under adverse city conditions. Although the tree is growing in an opening in the pavement less than two feet in diameter, and with a trunk which has been more than half girdled by injury for many years the tree appears in perfect health. Probably no other tree except the *Ailanthus* would have survived under similar conditions.

on city streets and possesses much beauty, especially in old age. It has very few enemies, is little subject to disease and is a rapid grower and long-lived. It normally makes a large tree, so is not adapted for use in narrow streets unless kept back by severe pruning. It is well adapted for such pruning, and is uninjured by it. This tree is to be used wherever a large tree is desired as on wide streets and avenues, or can be used as noted as a formally pruned, medium-sized tree for narrow streets.

(2) GINGKO BILOBA (*The Maidenhair Tree*).

This tree is extremely hardy and succeeds in very poor soil, and is very free from insects and disease as well as being a tree of considerable beauty. Its chief fault is its slow rate of growth, but for street use where a small-sized tree is required this defect is not serious. It is readily kept either round-headed or pyramidal in form by pruning. This tree would be especially valuable for use in Manhattan on narrow streets or where a formally pruned tree is required. It is doubtful if any tree on our list will succeed so well under adverse conditions as the Gingko.

(3) TILIA VULGARIS (*The European Linden*)*

This is the tree so much used as a street tree in European cities. It is a beautiful tree in both form and foliage and its bloom is delightful in fragrance. The tree is thoroughly hardy, succeeds under the adverse conditions of a city street and is a rapid grower, yet takes kindly to severe pruning.

The Linden has received a bad name in New York because many of the varieties which have been used lose their foliage in the warm weather of July and August due to the attacks of the red spider. If the true *Tilia vulgaris* is used this trouble will usually not be experienced. Great care should be exercised in securing the true species as nurserymen often offer under the name *vulgaris* another species

* The author is indebted to the article by F. L. Olmsted and H. J. Koehler in the July number of "Landscape Architecture" for the true nomenclature of the lindens as here used.



Photograph by L. D. Cox.

THE LINDEN AS A STREET TREE.

An example from New Haven of a Silver Linden (*Tilia tomentosa*) planted in a small tree pit beneath a sidewalk grating on a paved street. The grating and guard are similar to those recommended in Planting Specification No. 3.



Photograph by L. D. Cox.

EXISTING PLANTING ON WEST 86TH STREET.

THE NORWAY MAPLE AS A STREET TREE.

The trees are too crowded and about 50 per cent of them should be removed. A lighter guard, with the existing fences around the parking areas, would give ample protection and would be more economical and better looking. A square guard is difficult to keep in good appearance since a slight variation in alignment along the tree rows is very apparent. The round guard of Specification No. 4 would be better if a heavy guard must be used.



Photograph by L. D. Cox.

THE PIN OAK AS A STREET TREE.

Pin Oaks on a Manhattan street planted in tree pits with gravel surface similar to the requirements of Planting Specification No. 2. The surface of the tree pit should be kept lower than the sidewalk pavement in order to catch any available water. The soil should also be frequently cultivated as it is rapidly compacted by traffic. If these trees are not permitted to become too large, a very successful growth may be maintained.

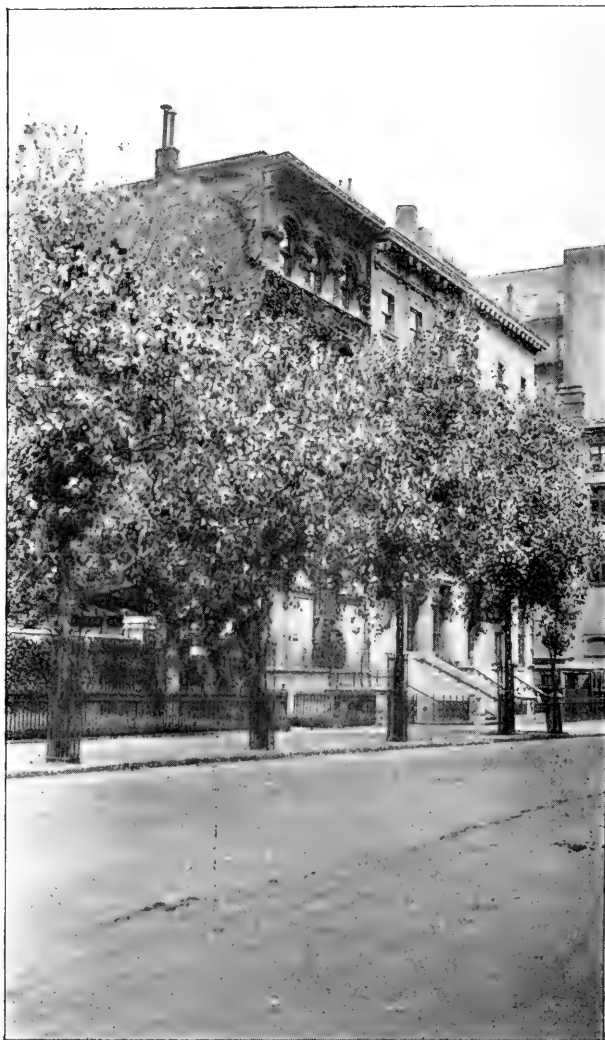
(*Tilia platyphyllos*) the large-leaved European Linden which is badly affected by the red spider and is a generally inferior tree in many ways. There are two other lindens, probably equally as good for street use as *Tilia vulgaris*. These are *Tilia cordata*, the small-leaved European Linden and *Tilia tomentosa*, the Silver Linden. These have not been used so long as street trees in America and so less is known about them.

(4) *ACER PLATANOIDES* (*The Norway Maple*).

This is the best Maple which can be grown successfully on city streets. There are several horticultural varieties of this tree on the market which may prove superior to the type when better known. The varieties differ from the type principally in form. Two of the best are *var globosum* which is very round and formal and *var columnare* which is tall and columnar. The type tree forms a round-headed, attractive appearing tree so well known that a detailed description is not necessary. While subject to a number of insect pests the tree can be kept in good health with reasonable care. The Norway Maple stands street conditions very well, but it is less hardy than the Plane and Gingko, and should only be used where soil and moisture conditions are fairly good. It is not as well adapted for use beneath gratings as the Linden, Plane or Gingko. The Norway Maple is to be recommended for use on residence streets where fair-sized tree pits or parking areas are available. The photo on page 16 shows the beauty of a street planted to Norway Maples when the trees are well grown.

5. *QUERCUS PALUSTRIS* (*The Pin Oak*).

While less hardy than the Plane and Gingko, the Pin Oak will make a splendid growth in a very restricted area if soil conditions are reasonably good. Being a slow grower it is very easy to keep it of small size by pruning and in this way the top may be kept in balance with the root growth where the space available for the roots is limited. An example of this is seen in the present successful planting on North Broad-



Photograph by L. D. Cox.

THE FORMALLY PRUNED POPLAR AS A STREET TREE.

This picture indicates the very pleasing effect which may be secured with this tree on a busy street if the trees are kept low and of formal shape by severe pruning. These trees are on lower Fifth Avenue, and form one of the most successful bits of tree planting in New York.

way where the trees are growing in a few feet of soil above the subway roof. This tree has few enemies, and can easily be kept in fine foliage. It is adapted for use as a normal sized tree in deep soil as well as for pruning to a limited size where the soil is shallow. The Pin Oak is no more hardy than the Red Oak, but on account of its slower growth is more adaptable to adverse street conditions.

6. *POPULUS DELTOIDES* (*var. Caroliniensis*). (*The Carolina Poplar*).

The Carolina Poplar is generally held in bad repute as a street tree because of the tendency of its roots to clog sewers and water pipes and because the brittle nature of its wood makes it liable to injury in storms. However, if the tree is kept pruned to a small size and formal shape, both these objections are largely overcome, and its luxuriant green foliage, even under the most adverse conditions, make it very valuable for certain locations. It is well adapted for use when pruned in this manner on congested business streets grown in a restricted tree pit beneath a grating. Being a rapid grower and easily moved when of fair size it would be possible with this tree to maintain uniform tree lines of formally pruned trees on streets where few other trees could be made to succeed.*

7. *AILANTHUS GLANDULOSA* (*The Tree of Heaven*).

The Ailanthus is even more hardy than the Plane, the Gingko or the Poplar and requires a minimum of soil and water to succeed. This tree will grow luxuriantly where no other tree could exist, and this is its chief value in any list of street trees. In appearance it is fair, the foliage being rather coarse and tropical in effect, but always of a luxuriant green. The tree tends to grow straggly, and has a rather unsightly appearance in the winter. The Ailanthus

* The Shade Tree Commission of Newark has used the Poplar treated in this way with considerable success. There exists on lower Fifth avenue several trees thus pruned which are among the most effective and successful street trees to be found in New York.



Photograph by L. D. Cox.

THE AILANTHUS AS A STREET TREE.

An aged Ailanthus on lower Fifth Avenue bearing a healthy crown of foliage under conditions in which most trees would perish. The tree is growing in an opening in the pavement about 3 x 4 feet and the trunk is nearly girdled by bark injuries.

grows with a pithy center so that old trees often become dangerously weak while still appearing to be in full vigor. The habit of the tree can be much improved by formal pruning, and when used as a street tree should not be allowed to attain too large a size. The Ailanthus is recommended for use especially south of 59th Street where growing conditions are worst. The tree is diœcious, and the female form should only be used, as the flowers of the male tree have a disagreeable odor. It would probably be necessary for the city to propagate the trees in its own nursery to make certain of the sex of the trees used.

The following additional list is suggested as comprising trees which might, under the most expert attention be grown successfully on Manhattan streets, but only on streets where conditions are most favorable. Such conditions would be found on wide streets with generous gravel or grass parkings, good depth of soil and where the buildings are moderately low and the traffic light.

1. QUERCUS RUBRA (*The Red Oak*).
2. ACER RUBRUM (*The Red Maple*).
3. FRAXINUS AMERICANA (*The American or White Ash*).
4. ULMUS MONTANA (*The Scotch Elm*).
5. ULMUS AMERICANA (*The American Elm*).
6. AESCULUS HIPPOCASTANUM (*The Horse Chestnut*).



Photograph by L. D. Cox.

SCIENTIFIC CULTURE WILL OVERCOME ADVERSE CITY CONDITIONS.

A planting of Pin Oaks on a Washington, D. C., street. This picture shows the excellent effect produced by these trees even when grown in small tree pits on a paved street. The openings in the pavement around these trees are approximately 4 x 8 feet. The planting approximates Planting Specification No. 2.

VII. How to Plant

A Detailed Consideration of Growing Conditions and Planting Methods

It is only when we come to consider the actual details of planting that we find, as suggested in Chapter II, the difficulties which beset successful tree growth in Manhattan. The problems which must be solved, in addition to those normally met in street tree culture such as protection against physical injury and the ravages of insects and disease, are of two general classes:

- (I) Those which pertain to securing and maintaining correct soil conditions.
- (II) Those which pertain to securing and maintaining correct crown conditions.

The latter consist principally in adjusting the size of the crown to the available sidewalk widths and to the capacity of the roots in their restricted soil areas. Such problems can largely be solved by correct pruning which is not difficult to secure.

By keeping a perfect balance between the top growth and the root system one may often secure a successful street tree even when soil conditions are generally bad and where a large-sized tree would almost certainly fail.

A correct adjustment of the tree shade for any street to the supply of light and air necessary for the lower stories of the buildings upon the street depends largely upon the sidewalk width and the planting design. There can be no question but that limiting top growth by severe pruning is often advisable for reasons of health and hygiene as well as for the aesthetic reason of improving the design and the purely horticultural reason of securing successful growth. This matter has already been mentioned in Chapter IV.

The problems which have to do with soil conditions are less simple of solution and yet it is upon the skill shown in solving them that the success or failure of the whole operation must depend. To secure correct soil conditions it is necessary to provide for each and every tree as follows:

(1) *A sufficient amount of good soil.*

In some cities no consideration has to be given to this matter as the existing soil is satisfactory both as regards quality and amount. In Manhattan this is practically never the case, and generally speaking we must figure on providing at least two cubic yards of first-class loam or topsoil and this even when there is a subsoil of some value. When, as in the case of the restricted tree pit, we must provide the entire soil supply of the roots the minimum requirement should be three cubic yards, while five would be better. In Paris three cubic yards of good soil is the standard requirement in planting new trees.

(2) *Sufficient moisture.*

In the writer's opinion this is the most important element in successful tree growth. In the case of trees planted in very restricted areas this can only be supplied by artificial means. Even where a good subsoil exists, it is doubtful if the tree can secure, unaided, sufficient moisture for its needs even after being established. The reason for this is that the continuous pavement of the ground surface prevents the ground water from being replenished from natural sources. To secure successful street trees in Manhattan, continuous irrigation is advised in practically all cases. There are various ways of providing this, such as by tile and "dry wells, or by some form of underground pipes as in the so-called "automatic" lawn sprinkling systems in use in the arid regions of the southwest.*

A method of irrigation advocated by some authorities is to pierce the gutter curb opposite the tree and secure in this

* Discussed in detail by the writer in the American City Magazine, September, 1914.

way the water from street flushing and storms. Before the advent of the automobile and the use of oil as a dust layer or in road construction this method was of value, but today the injury from the oil and grease which would be thus washed into the soil around the tree roots would more than offset the value of the water received. This has been found to be the case by German tree experts who formerly made use of this practice.

Where a grating is used over the surface of the tree pit some water is secured from the rains by way of the sidewalk and the rest can be provided by weekly or fortnightly flooding with a hydrant hose or sprinkling wagon.

Where bricks laid in sand are used instead of a tree grating as a traffic surface for the tree pit, a tile or dry well system or the underground pipe system of irrigation will be needed. These methods are also suitable for trees in unfenced gravel parkings or continuous strips paved with bricks laid in sand. In the case of trees grown in grass parkings or gravel areas protected from traffic by fences, an occasional heavy surface watering will usually be sufficient if the grading is such that a good supply is held in a depression around the tree trunk.

The amount of water needed by any tree or street of trees will depend upon the species of tree, the physical characteristics of the soil, the drainage below ground, the rainfall, the season of the year, etc., and can only be determined by experience.

(3) *Proper drainage.*

The securing of proper drainage follows, of course, as a corollary of the above, and if the subsoil does not provide for it adequately, underdrainage in some form must be provided artificially. A layer of loose stones and a tile to the nearest low-lying sewer will provide such drainage in the simplest and most effective way. Sometimes dynamiting the subsoil will provide adequate drainage if the substrata are suitable.

(4) *Proper aeration of the soil.*

Next to a supply of water, a well aerated soil is the most necessary condition for successful tree growth. Probably more street trees in Manhattan die because of a deficiency in respect to air and water than from any other cause.

Where a tree is not planted in turf, the only way to insure a proper aeration of the soil is by frequent cultivation of the ground surface above the roots. All street trees planted in gravel parkings or in tree pits with or without gratings should receive such treatment at least every three or four weeks during the growing season. In the case of gravel surfaced tree pits which are protected by a fence from traffic or in the case of tree pits surfaced with brick laid upon a good cushion of loose sand it is probably only necessary to cultivate two or three times a season.

Where gratings are used they should be of a design which permits of easy removal for frequent cultivation. The chief value of the grating lies in its improvement of aeration conditions by protecting the ground surface from becoming compacted by traffic. Hence an immovable grating which prevents frequent cultivation destroys its main reason for existence. There are a number of gratings in Manhattan which are thus largely worthless. The soil beneath a grating, because of the nearly continuous shade, will soon grow sour and prevent proper aeration if not cultivated.

(5) *A supply of plant food.*

Sufficient food for a successful street tree will be largely secured from good soil, and sufficient air and water without fertilization, but where the soil supply is unusually limited an annual application of fertilizer is advisable. Bone meal, lime, well rotted manure, and various chemical fertilizers rich in phosphates and nitrates may all be used with success. Where gratings are used oats or clover may be planted in early summer and dug under when four or five inches high, or dead leaves may be piled under the gratings in the fall and covered with a light dressing of well rotted manure and the whole spaded under the following spring. In the use of

fertilizer in growing street trees conditions and experience must guide our practice.

As has already been noted, great variation in use and conditions between different streets makes any single method of planting or any hard and fast planting specification unwise. If such a single standard should be adopted it would be extremely inefficient. If a specification were selected which would be appropriate for streets where conditions are unfavorable it would entail a large and unnecessary expense for planting under more favorable conditions. On the contrary a specification suitable for streets with favorable growing conditions would result in failure on many others. With this idea in mind several types of planting with their corresponding specifications have been suggested. Some one of these types will be found suitable for every Manhattan street in which planting is possible or advisable.

The various streets upon which planting is suggested may be grouped into three general classes with regard to the type of planting appropriate for each.

I. Those streets where growing conditions are very good, and where trees can be planted in grass or gravel parkings. (Planting to be done according to Planting Spec. No. 1.)

II. Those streets where growing conditions are reasonably good, and where trees can be planted in parking areas or tree pits either with or without sidewalk grating or other form of ground surface protection and where light tree guards are sufficient. (Planting to be done according to Planting Spec. No. 2 and 3.)

III. Those streets where growing conditions are hardest, and where the trees must be planted in small tree pits and provided with gratings and where on account of the traffic heavy guards are necessary. Planting to be done according to Planting Spec. No. 4 and 5.

The accompanying map shows our proposed and possible street tree system divided into these three classes or zones differentiated on the map by color.*

* This map being of purely administrative value has been omitted from the published report.

Five types of planting specifications which the writer has compiled or originated are recommended as follows together with the classes of streets for which they are appropriate.* Details of both specifications and estimates will be found in the next chapter.

I. STREET TREE PLANTING SPECIFICATION No. 1.
(Estimated cost \$10 per tree.)

This specification is suggested for use under the most favorable conditions and is adapted for residence streets, parkways and boulevards when parking strips or fenced parking areas (either grass or gravel) already exist or may be secured. This specification will apply, of course, to streets with central as well as side parkings.

NOTE.—The estimated cost does not cover the cost of iron fences around the parking strips or areas if these are necessary, or the uncovering of the parking strip or area if the same is at present paved.

II. STREET TREE PLANTING SPECIFICATION No. 2.
(Estimated cost \$15–\$20 per tree.)

This specification is for use under fairly favorable conditions and is adapted for residence streets or business streets which do not contain parking strips but where the sidewalks are wide and the traffic does not demand gratings or heavy guards. The tree pits may be kept in grass (fenced) or gravel or the surface may be paved with brick laid in sand.

* The writer wishes to acknowledge that many suggestions and ideas respecting the details of these specifications were derived from a study of the tree-planting work and writings of the following men: A. A. Shurtleff, Landscape Architect; F. L. Olmstead, Landscape Architect, both of Boston; City Forester George A. Cromie of New Haven; Secretary Carl Bannwart of the Shade Tree Commission of Newark; City Forester H. B. Filer of Buffalo; City Engineer Frank R. Lanigan of Albany, N. Y. Acknowledgment is also made to the following men for detailed replies to letters of inquiry regarding Street Tree Practice and experience in their respective cities: John Boddy, City Forester, Cleveland; R. B. Maxwell, City Forester, Baltimore; H. J. Neal, City Forester, Worcester; L. F. Peck, Superintendent of Streets, Hartford.

III. STREET TREE PLANTING SPECIFICATION No. 3.
(Estimated cost \$25 to \$35 per tree.) Cost varies according to the style of grating used.

This specification is suggested for use under fairly favorable conditions and is adapted for residence or business streets where traffic conditions make gratings desirable or necessary, but where heavy guards are not demanded.

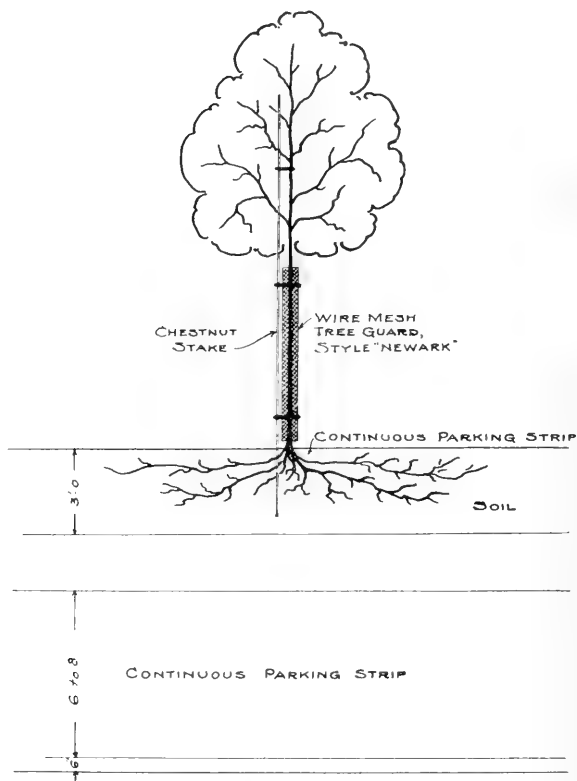
IV. STREET TREE PLANTING SPECIFICATION No. 4.
(Estimated cost \$40.)

This specification is for use under the most unfavorable conditions where tree planting is at all possible and is adapted for congested business streets where the traffic makes necessary an extra heavy tree guard as well as a grating.

NOTE.—This grating and guard have been specially designed with the idea of easy removal so that frequent cultivation of the soil is possible.

V. STREET TREE PLANTING SPECIFICATION No. 5.
(Estimated cost \$50 to \$60.)

This specification is for use under the same conditions as No. 4 and is adapted for the same class of streets. This specification is at present in use by the Park Department. It differs from Specification No. 4 in that the tree guard is square instead of round, and of lighter construction, while the area of the grating is slightly larger. This specification is admirable save for the fact that the difficulty of removing the grating makes frequent cultivation impossible. While a degree of cultivation may be given through the openings in the grating, such cultivation will never be wholly satisfactory.



DETAIL SKETCH
STREET TREE PLANTING
SPECIFICATION N°1

L. D. Cox, L. A.

The details of this planting specification are given on the opposite page.
The estimated cost is \$10.00 per tree.

VIII. The Cost of Planting

The Details of the Standardized Planting Specifications and the Estimated Cost

The specifications and estimates for the five types of planting described as recommended above are here given:

I. STREET TREE PLANTING SPECIFICATION No. 1.

(a) *Sub-Soiling:*

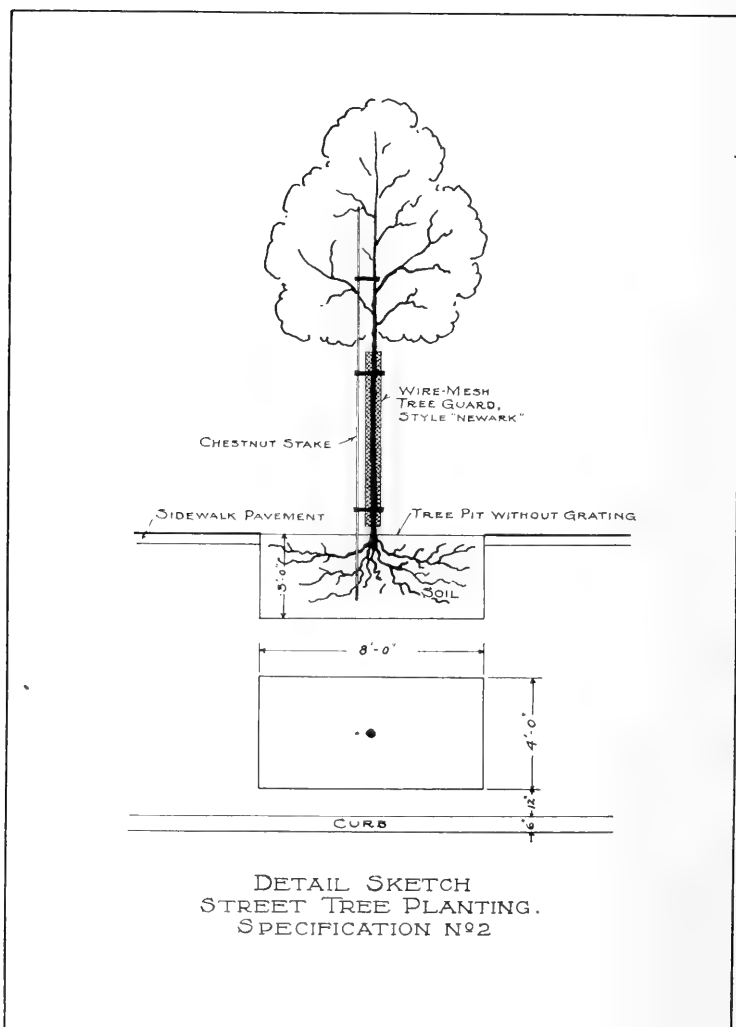
A tree pit shall be constructed 4x6 feet in area and 3 feet deep. It shall be excavated and refilled with good soil bringing in from the outside as much new top soil as may be necessary, and hauling away all sub-soil so replaced. If the natural drainage is not satisfactory, suitable underdrainage with tile shall be provided. Where rock is encountered at the bottom of the pit this shall be shattered to a depth of several feet by a charge of low-grade dynamite.

(b) *Fertilizer:*

Ten pounds of bone meal shall be applied, mixed thoroughly with the soil of the tree pit and a top dressing of two inches of well-rotted stable manure shall be given after the tree is planted. This top dressing shall not be placed nearer to the trunk of the tree than 18 inches.

(c) *Tree:*

The tree used shall be from 1½ to 2 inches in caliper, straight of stem and symmetrical in form, of vigorous growth provided with compact fibrous roots. The trees in any single block shall be pruned at the time of planting to secure similar height, shape and size, and no branches shall be left which shall be lower than 7 feet from the surface of the sidewalk after the tree is planted.



The details of this planting specification are given on pages 65 and 67.
The estimated cost is \$15.00 per tree.

(d) Guard:

A galvanized wire guard of $\frac{1}{2}$ inch square mesh distinguished as style "Newark" on the attached detail drawing shall be provided. This guard shall be wrapped tightly around the trunk of the tree and secured with galvanized wire, being kept from any possible contact with the bark by a ring or washer of rubber hose provided at the top and bottom of the guard.

(e) Stake:

A chestnut or oak stake $2\frac{1}{2}$ inches square and 12 feet long shall be provided. The stake shall be driven firmly into the ground outside the guard and attached securely to the guard at top and bottom with galvanized wire. Above the guard the stake shall be fastened to the tree with canvas strips or rubber hose. (For this tie it is recommended to use a special material known as "Two-ply cotton belt" $2\frac{1}{2}$ inches wide, manufactured by the Buffalo Mill Supply Co.) Care shall be taken that the stake shall in no place come in contact with the bark of the tree. Before use, the stake shall be dipped in hot tar or creosote to a depth of four feet and the remaining portion of the stake shall be covered with a creosote stain, dark green in color.

Estimate:

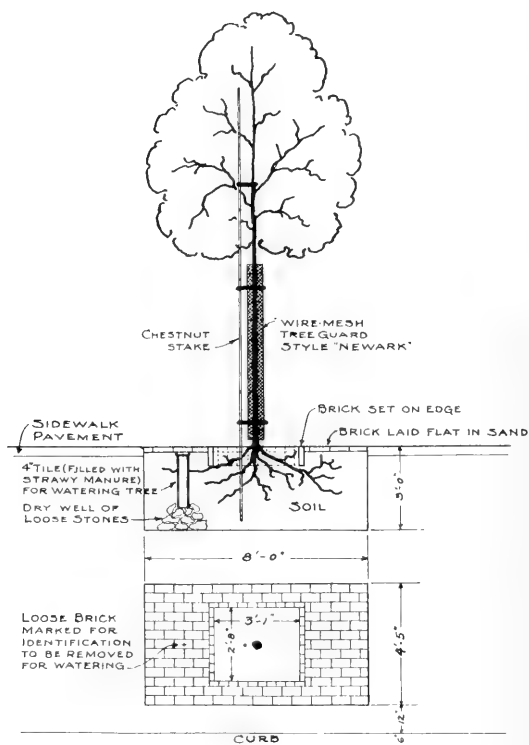
Excavating and sub-soiling.....	\$4 00
Tree delivered	1 50
Stake.....	50
Guard and attachments.....	1 00
Planting and miscellaneous labor.....	1 00
Cultivation and replacements until tree is established	2 00

\$10 00 per tree

II. STREET TREE PLANTING SPECIFICATION No. 2.

(a) Cutting pavement

The pavement of the sidewalk over the area of the proposed tree pit shall be removed so as provide an opening



DETAIL SKETCH
STREET TREE PLANTING
SPECIFICATION N^o 2
(BRICK SURFACE OVER TREE PIT.)

L. D. Cox, L. A.

The details of this planting specification are given on the opposite page.
The estimated cost is \$20.00 per tree.

4' x 6' 2" in area. The outer or street edge of this opening shall be one foot from the outside edge of the sidewalk curb. The margins of the opening thus made shall be finished in a workmanlike manner.

NOTE.—The size of the opening is such that a standard grating can later be installed if needed.

(b) The detail requirements regarding *sub-soiling, fertilizer, tree, guard* and *stake* shall be as stated in Planting Specification No.1.

Where the surface of the tree pit is to be paved with brick the following requirements shall apply.

(c) *Brick Surface*

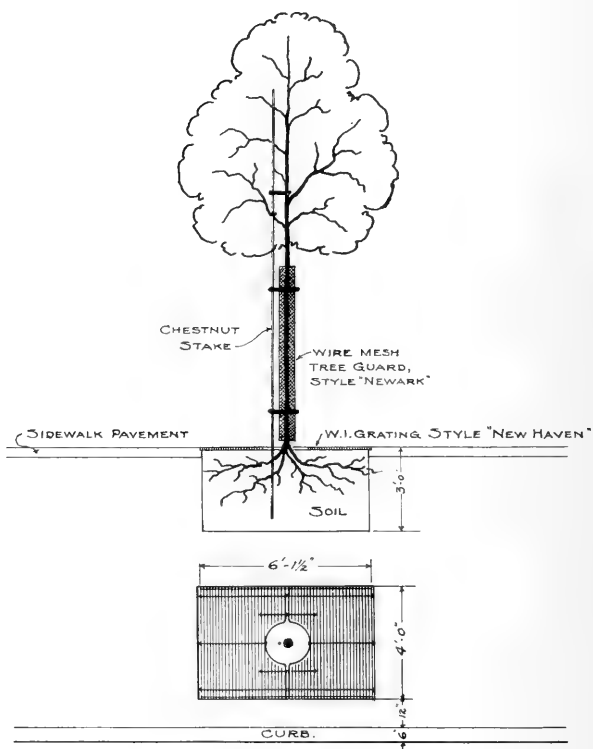
The opening in the pavement over the area of the proposed tree pit shall be of the size shown on the accompanying drawing illustrating "Planting Specification No. 2, with brick surface."

The surface of the pit shall be paved with hard burned vitrified standard size brick laid upon a 2-inch layer of clean coarse sand. The bricks shall be laid with a half-inch joint and in the manner shown on the drawing and the joints shall be filled with sand.

A tile and dry well shall be provided to supply irrigation, located and constructed as shown on the drawing.

Estimate:

Excavating and sub-soiling.....	\$6 00	
Cutting and trimming pavement.....	2 00	
Tree delivered	1 50	
Stake	50	
Guard and attachments.....	1 00	
Planting and miscellaneous labor.....	1 00	
Cultivation and replacements until tree is established	3 00	
	<hr/>	
with gravel surface	\$15 00	per tree(a)
Brick surface	5 00	
	<hr/>	
with brick surface	\$20 00	per tree(b)



DETAIL SKETCH
STREET TREE PLANTING
SPECIFICATION №3
GRATING STYLE "NEW HAVEN".

L. D. Cox, L. A.

The details of this planting specification are given on the opposite page.
The estimated cost is \$25.00 per tree.

III. STREET TREE PLANTING SPECIFICATION No. 3.

(a) *Cutting Pavement:*

The sidewalk pavement over the area of the proposed tree pit shall be removed so as to provide an opening 4' x 6' 2" or 4' x 6' 7" according to the style of tree grating to be used. The outer or street edge of this opening shall be one foot from the outer edge of the sidewalk curb. The margins of the opening shall be provided with a half-inch ledge finished in a workmanlike manner. This ledge shall receive the grating in such a way that the grating shall lie flush with the sidewalk.

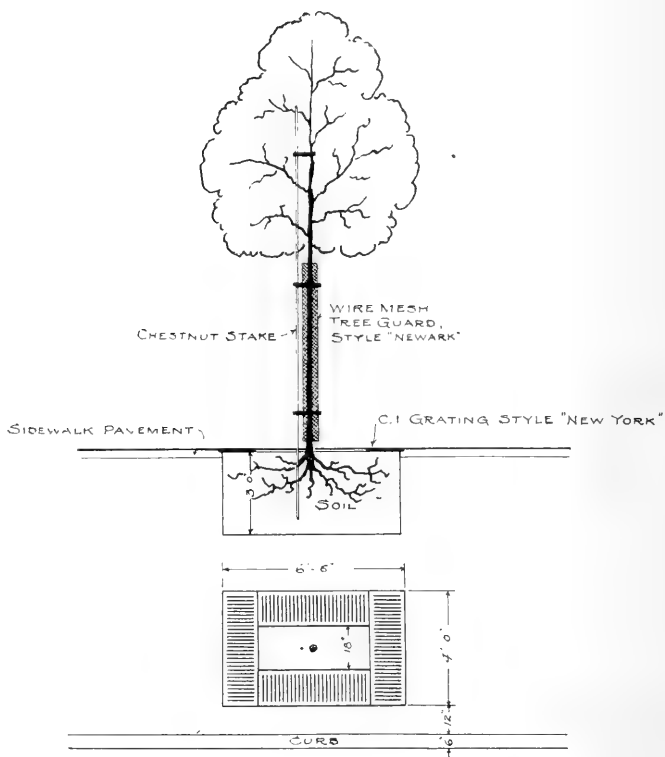
(b) *Grating:*

A wrought or cast-iron grating of size and construction know as style "New Haven", style "New York" or style "Knickerbocker" shall be provided (as illustrated in drawings of Planting Specification No. 3).

(c) The detail requirements regarding *sub-soiling, fertilizer, tree, guard and stake* shall be as stated in Planting Specification No. 1.

Estimate:

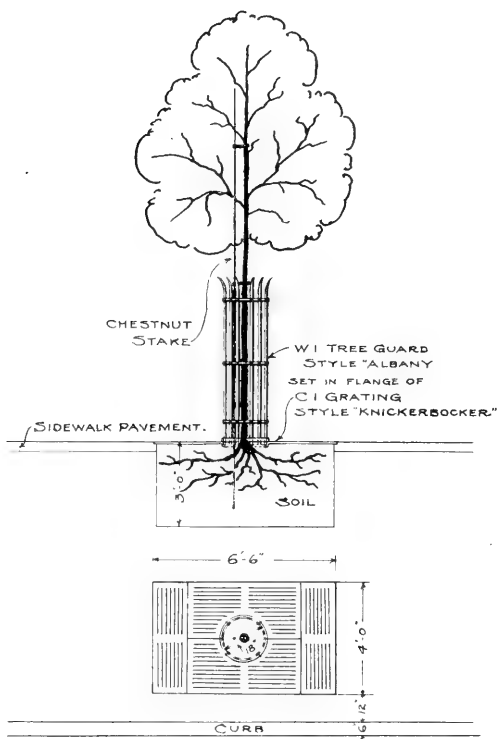
Excavating and sub-soiling.....	\$6 00	
Cutting and trimming pavement.....	3 00	
Tree delivered	1 50	
Stake.....	50	
Guard and attachments.....	1 00	
Planting and miscellaneous labor....	1 00	
Cultivation and replacements until tree is established.....	2 00	
Grating (style "New Haven").....	10 00	
		\$25 00 a tree (a)
NOTE.— With the grating style "New York" costing \$15.00 the estimate becomes.....		
	\$30 00	a tree (b)
With the grating style "Knicker- bocker" costing \$20.00 the estimate becomes.....		
	\$35 00	a tree (c)



DETAIL SKETCH
STREET TREE PLANTING
SPECIFICATION N°3,
GRATING STYLE "NEW YORK".

L. D. Cox, L. A.

The details of this planting specification are given on page 69.
The estimated cost is \$30.00 per tree.



DETAIL SKETCH
 STREET TREE PLANTING
 SPECIFICATION No 4.
 GRATING STYLE "KNICKERBOCKER."

L. D. Cox, L. A.

The details of this planting specification are given on page 72.
 The estimated cost is \$40.00 per tree.

IV. STREET TREE PLANTING SPECIFICATION No. 4.

(a) Cutting Pavement:

The sidewalk pavement over the area of the tree pit shall be removed so as to provide an opening 4' x 6' 7". The outside or street edge of this opening shall be one foot from the outside edge of the sidewalk curb. The margin of the opening shall be provided with a half-inch ledge to receive the grating in such a way that the grating shall lie flush with the sidewalk.

(b) Grating:

A cast iron grating 4' x 6' 6" designated as style "Knickerbocker" shall be provided. This grating is shown on the accompanying drawing of Planting Specification No. 4.

(c) The detail requirements regarding *sub-soiling, fertilizer, tree, guard* and *stake* shall be as stated in Planting Specification No. 1.

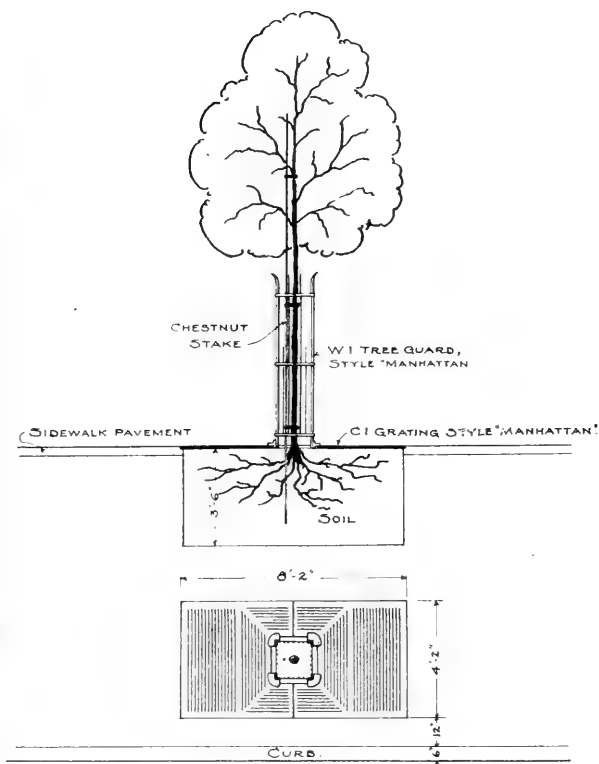
Estimate:

Excavating and sub-soiling	\$6 00
Cutting and trimming pavement.....	3 00
Grating.....	20 00
Guard.....	7 00
Tree delivered	1 50
Stake.....	50
Planting and miscellaneous labor.....	1 00
Cultivation and replacements until tree is established.....	1 00

\$40 00 per tree

V. STREET TREE PLANTING SPECIFICATION No. 5.

This is the type of specification already in use by the Park Department, detailed specifications and drawings of which are on file in the office of the landscape architect of the department. The estimated cost of this type of planting is from \$50 to \$60 per tree, according to number of trees planted at one time. (See estimate in office of Landscape Architect of Park Department.)



DETAIL SKETCH
STREET TREE PLANTING.
SPECIFICATION N° 5.
GRATING STYLE "MANHATTAN"

L. D. Cox, L. A.

This planting specification is described on page 72.
The estimated cost is \$50.00-\$60.00 per tree.

IX. The Organization and Budget

A Street Tree Bureau and the Estimated Cost of Its Operation

If we examine the details of street tree control in various American cities we find that there are in general use three quite different forms of street tree administration.

I. That in which the authority over street trees is placed in the hands of an independent board or commission.

II. That in which this authority is exercised by a Bureau of the Park Department.

III. That in which this authority is exercised by some other bureau such as the Street Department or the Board of Public Works.

The second plan is without doubt the best, and the one in most common use. In the case of New York City this form of administration is provided for by charter, and the authority over street tree maintenance and planting in each borough is placed in the hands of the Borough Park Department.

In approaching the problem in Manhattan therefore it is only necessary to perfect an arboricultural organization already possible or existing in the Park Department, and to determine the annual revenue which will be necessary for the maintenance of such an organization.

With the idea of arriving at an accurate estimate as to the probable cost of adequate street tree control in Manhattan, an investigation has been made of the cost of similar work in a number of American cities where efficient departments of city forestry are maintained. It is of course as difficult as in the case of park operation, to standardize exactly such a peculiar type of public service as street tree control. However, if the cost figures of various cities are interpreted with

the knowledge of the differing local conditions some degree of basic comparison may be made.

In estimating the cost of street tree control in Manhattan it is necessary to note first the cost for the trees which are to be maintained, both existing and proposed, and second the cost of the new planting. The system of street tree planting which is outlined on the map accompanying this report provides for approximately eighty-five miles of planted streets which would give, at the rate of 200 trees to the mile (the number secured by following the spacing arrangement of our proposed block planting plans), approximately 17,000 trees. There is perhaps a street mileage half as great which is not included in the system, but upon which street trees may be grown successfully if desired (i. e., streets purely residential in character, lying in the proposed restricted residential districts). Assuming 8,000 trees to be the number required for such streets we get a total of 25,000 trees as the number of street trees which may be ultimately secured in the Borough of Manhattan.

The street tree census, which was completed by the writer as far north as 110th Street, recorded 5,400 trees. From a careful examination of the balance of the Borough, it would seem that a reasonable estimate would place the number of street trees south of 110th Street at about one-third of the entire number in the city, so that an estimate of 15,000 is a fairly accurate one as to the number of existing trees upon Manhattan streets. Fully two-thirds of these existing trees are, however, in a very unsatisfactory condition, and probably not more than 5,000 can be considered a part of our permanent planting.

Our problem thus becomes the preservation of the 5,000 existing trees which are of permanent value, and the replacement of the 10,000 inferior or deteriorating trees, together with the planting of an additional 10,000 new trees on streets not now planted. Our maintenance operations will therefore begin with the total of 15,000 trees which, allowing for the removal of dead and dying specimens, may be considered to be increased each year by one-half the

number of the trees annually planted assuming an annual planting of 1,000 trees, until the 10,000 inferior trees are replaced, and the annual increase is only sufficient to equal replacements. The number of new trees which shall be planted is of course only limited by the funds available, and, if a really progressive policy is to be adopted, should not be less than 1,000 trees, or five miles of our proposed system, until the 10,000 additional new trees are secured.

Based on these figures, a tree planting program for a five-year period from date would give an annual maintenance and planting problem somewhat as follows:

First year: Maintenance of 15,000 trees. New planting of 1,000 trees.

Second year: Maintenance of 15,500 trees. New planting of 1,000 trees.

Third year: Maintenance of 16,000 trees. New planting of 1,000 trees.

Fourth year: Maintenance of 16,500 trees. New planting of 1,000 trees.

Fifth year: Maintenance of 17,000 trees. New planting of 1,000 trees.

It is evident then that if we can learn the average expense per tree for annual maintenance, and also the cost of our new planting, we can establish very accurately the annual budget which will be necessary for our proposed Bureau of City Forestry, and hence the size and scope of the required organization.

Maintenance:

As has been said above, it is very difficult to standardize the cost of street tree maintenance. The city of Paris, world-famous for the beauty of its street trees, finds it necessary to spend \$1.25 per tree for annual maintenance. We have no American city with similar conditions maintaining its trees at the same degree of excellence, and, in those American cities where first-class street tree maintenance is secured.

the conditions do not resemble those in Manhattan as much as the Paris conditions do.

The city of Newark, N. J., spends fifty cents per tree per year for its street tree maintenance. The Newark trees are extremely well maintained, but the majority of their trees are grown in grass parkings under the best conditions, and also the number of old trees is small, so that the cost of removals is at a minimum.

In Buffalo, with even better growing conditions where the trees nearly all exist on parkways or residential streets with wide parkings, and also where the number of removals is small, the cost is but twenty-five cents per tree.

In New Haven the cost of maintenance is approximately thirty cents per tree. Here again growing conditions are excellent, and the increased cost over that of Buffalo is probably due to the greater number of removals made necessary because of the great preponderance of aged trees in New Haven. In all of these cities conditions are much better than those of New York — and the cost figures under the conditions of Paris as noted above are of much more value as a means of comparison. Considering these factors, an estimate of \$1 per tree per year would certainly seem to be a minimum estimate for maintaining trees in Manhattan streets. If we assume this figure, we would then require, to maintain the existing 15,000 trees in Manhattan, an original appropriation for maintenance alone of \$15,000 per year. This sum would increase with the increase due to the annual planting increase of 500 trees, \$500 per year until the system was complete.

The Boroughs of Manhattan and Richmond, according to the figures of the last annual report, received a budget appropriation for the care of trees in streets amounting in round numbers to \$18,000. As the greater part of this sum is expended in Manhattan it should be practically sufficient for first-class maintenance under proper street tree organization. However, under the present arrangement the same forces have charge of tree maintenance in both streets

and parks, and as a natural consequence a large part of this sum goes for the care of park trees rather than for street trees.

New Planting:

To secure the total budget for the proposed street tree bureau we must add to the expense of maintenance the amount which will be required for the annual new planting.

The cost of planting street trees will be found to depend just as in the case of maintenance upon local conditions, and when we come to examine the planting costs in various cities we find even more striking variations than in the case of maintenance costs.

The cost of planting and establishing a street tree in various cities where systematic street tree planting is being done is as follows:*

In Cleveland (planting only).....	\$3 00
In Hartford	3 30
In Worcester.....	3 25
In New Haven	4 00
In Newark.....	4 65
In Baltimore.....	6 00
In Minneapolis	6 46
In Buffalo.....	7 00
In Brooklyn.....	8 00
In Newark (with gratings).....	10 65
In New Haven (with gratings).....	17 00
In Albany (with gratings).....	35 00
In Boston, work done by contract including replacement guarantee	40 00

It is only in these latter cases that the type of planting at all corresponds with the type which is demanded on the majority of Manhattan streets.

Careful estimates of tree planting according to the five different types of Planting Specifications, some one of which

* Estimate or exact figures furnished by the officials in charge of street tree work.

will meet all possible street conditions in Manhattan, have been made and already described. The lowest of these estimates, that of Planting Specification No. 1, gives a cost of \$10 per tree. This type of planting corresponds with that being done under similar conditions in Baltimore, Buffalo and Brooklyn, at similar cost. The most expensive type of planting as suggested for Manhattan, such as is represented by Planting Specifications Nos. 4 and 5 give an estimated cost of from \$40 to \$60 per tree. The type of planting which will be most commonly demanded in Manhattan, and which is represented by Planting Specifications No. 2 and 3 gives an estimated cost of from \$15 to \$35 a tree, according to the type of grating or surface treatment of tree pit used. These types of planting correspond with that being done under similar condition at figures of \$17, \$35, and \$40 in New Haven, Albany and Boston.

While it is difficult to determine exactly the proportionate amounts of planting, according to the various types of planting specifications, which must be done in Manhattan each year, a fairly accurate estimate will be as follows:

Fifty per cent according to Planting Specification No. 2.

Twenty-five per cent according to Planting Specification No. 3.

Fifteen per cent according to Planting Specification No. 1.

Ten per cent according to Planting Specification No. IV.

On this basis with 1,000 trees, suggested as the amount of the annual planting, we would get an estimated cost for the new planting each year as follows:

500 trees @	\$15 00	\$7,500
250 trees @	25 00	6,250
150 trees @	10 00	1,500
100 trees @	40 00	4,000
		<hr/>
		\$19,250

Supervision:

The only additional expense save planting and maintenance would be for supervision and equipment, which is estimated at \$7,500, the details of which estimate appear below.

We now find that the budget for our five-year planting and maintenance program described above becomes as follows:

First Year:

Maintenance of 15,000 trees @ \$1 per tree.....	\$15,000
New planting, 1,000 trees (see above estimate) ..	19,250
Supervision and equipment, estimated.....	7,500
	<hr/>
	\$41,750

Second Year:

Maintenance \$15,500*	\$15,500
New planting	19,250
Supervision and equipment.....	7,500
	<hr/>
	\$42,250

<i>Third Year</i>	\$42,750
<i>Fourth Year</i>	\$43,250
<i>Fifth Year</i>	\$43,750

Adopting the 1,000-tree program which is advocated, and which would seem a reasonable minimum if any serious progress is to be made in perfecting the suggested system, would require twenty-one years to complete the entire tree-planting program and eleven years to complete the main system. The budget for the twenty-first year would be \$51,750, which year would see the completion of the entire tree-planting program. Thereafter an annual budget of \$35,000 or \$40,000 should be sufficient to maintain the system in excellent condition and take care of all replacements due to the injuries or mortality.

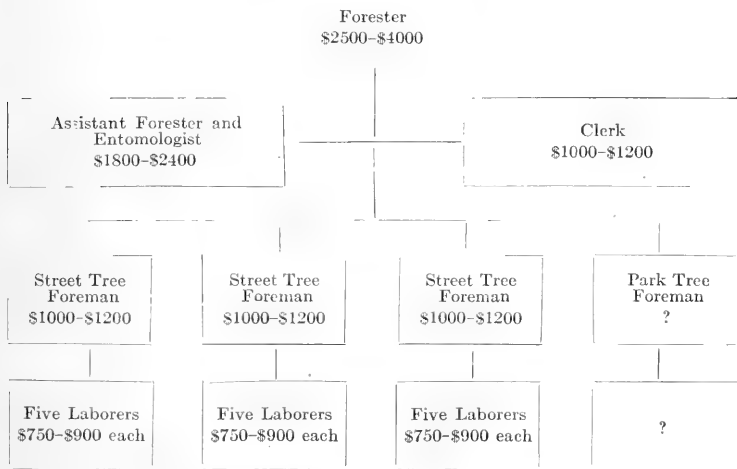
The conditions in Richmond are so radically different from those in Manhattan that it is impossible to furnish a combined estimate for the two boroughs. A sum of from

* Annual increase in maintenance due to annual increase in number of trees.

\$5,000 to \$10,000 a year for the next decade, spent under the jurisdiction of the Manhattan organization would probably secure for Richmond a satisfactory condition in the matter of street trees.

THE BUREAU ORGANIZATION

If systematic street tree control is to exist in Manhattan, a Bureau of City Forestry must be created, and the control of such bureau must be in the hands of a forestry expert. A typical organization for such a bureau of forestry capable of carrying out the program we have already outlined could be secured by an organization composed as follows:



The head of the Bureau, or City Forester, should be a man with technical training in arboriculture and landscape engineering, and with experience in the care and control of park and street trees. The salary suggested is from \$2,500 to \$4,000, according to the ability, experience and years of service in the department.

There is also suggested an assistant to the forester, a man of similar training and with a special knowledge of entomology. This man should have considerable experience in

the theory and practice of combating the diseases and insects which attack park and street trees, and should be capable of taking active charge of the spraying operations for the street tree bureau. There would also be necessary a clerk to handle all office records and permits, keep the cards of the street tree census up to date and carry on the necessary correspondence of the Bureau.

The laboring forces as suggested would consist of three experienced foremen who will have direct charge of the street tree laborers, handling spraying, cultivating, watering and pruning operations, the replacing of young trees, and the removals of old ones. The three gangs suggested would have an average force of five men each, to be increased as necessary in the planting and spraying seasons. There would also be one or more foremen as required, having charge of the care of the trees in parks. These men with their working forces would be paid from the park operation funds, and so are not included in our estimate.

The budget for the first year of the program based on the proposed organization, and with the foregoing estimates of supervision, planting and maintenance costs can now be examined in detail. It would be as follows:

I. Supervision and Equipment:

OFFICE AND OVERHEAD

(1) Forester	\$2,500	
Entomologist	1,800	
Clerk	1,000	
(2) Equipment	2,200	
	<hr/>	\$7,500

An imperative immediate need in Manhattan is automobile transportation for present power sprayers.

II. Maintenance:

Three foremen at \$1,000 each	\$3,000	
Fifteen laborers at \$750 each	11,250	
Teaming estimate	3,000	
	<hr/>	\$17,250

(\$2,250 of this amount is for labor in establishing and replacing young trees and is chargeable to new planting.)

III. *New Planting:*

(Estimate \$19,250; see above.)

Amount charged to new planting for labor in establishing and replacing young trees is \$2,250, leaving a balance of	\$17,000
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Total	\$41,750
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NOTE.—The annual estimate of \$2,200 for equipment should be sufficient to take care of salary raises during the first few years, since the demand, for new equipment will steadily decrease after the first year.

X. The Street Tree Census

Its Purpose and Value

The idea of a street tree census is one which has received much attention by city forestry departments, and one which appeals to any city street tree administration upon first approaching the street tree problem. The value of a permanent tree record to a bureau or department of city forestry is self-evident.

It is difficult if not impossible to secure economy and efficiency in maintenance cost without knowing the number and kinds of trees being maintained, while without a census kept up to date the labor and cost of inspection and investigation will be increased many fold. However, the clerical labor involved in securing a tree census, as such is commonly kept, and the maintaining of it after it has been secured, has caused many city forestry departments to abandon the scheme. In approaching this problem in Manhattan the writer realized the necessity of securing a form of census which would eliminate the labor and effort of a single-tree-card-system, book system or map system. After considerable experiment a card system especially adapted to conditions in Manhattan has been worked out which will, it is believed, secure the desired results with a minimum of effort and expense.

The tree census based on this form of card can be very easily made in the first place, and then kept up to date with a modicum of labor when completed. The block is made the unit for the individual card. All reference to tree species and details of planting are made by number or letter. The record is to be kept in pencil to be erased and changed as any changes occur in tree conditions so that it is seldom if ever necessary to make duplicate cards or repeat a record.

individual tree in any section of the city, and to learn the kind, size and condition of the tree or trees in question. The saving in time in investigating complaints regarding trees already several times investigated will alone be worth the cost of the census. In addition to the information regarding existing trees on any street the cards will also carry the information regarding each block in the city as to the desirability of planting and the variety of tree and the type of planting specification recommended. This information is to be derived from the results of the investigation of this report or from additional study of the problem made by the future forestry bureau. It is needless to point out the value of such information thus readily accessible not only to the officers in the park department but to those of other city departments which have to do with the control and construction of streets.

With the establishment of a forestry bureau, maps should be prepared upon the basis of the card census indicating by color the location of the various kinds of trees. Such maps would be invaluable in handling the spraying work of the department. Certain varieties of trees require spraying at one time of the year and others at another, and no man can carry in his memory the exact location of all the trees in a district so large as Manhattan. Without such maps there will always be a considerable variation in the efficiency of the spraying campaign from year to year.

The information of this census should be further complemented by a map showing the location of all past and future planting, and thus serve as a record of progress when used in connection with the maps of the proposed street tree system which accompanies this report.

XI. Street Tree Planting in Richmond

The problem of planting and maintaining street trees in the Borough of Richmond is, of course, radically different from that in Manhattan, since the general condition in the various towns and villages of Staten Island are normally those of a suburban community. One would naturally expect to find on Staten Island conditions for growing street trees of a most favorable nature, and in many cases this is true. However, due to the unusually narrow streets which prevail, this is not always the case.

It is doubtful if we will find anywhere in the country streets with such uniformly narrow parkings (often no more than twelve or eighteen inches wide), as exist in this borough. The condition has doubtless come about as a result of adapting modern street design with its paved roadway, curbs and sidewalks to ancient country roads, without having these roads replated, widened and laid out as city streets of normal street widths. This condition is a very serious one not only from the standpoint of the city forester but from that of the city planner who must foresee a growth to city conditions in this borough similar to that taking place in the other sections of New York City. It may be and probably is out of the question to widen the older streets at this time, although it may have to be done some day. However, all new streets should certainly be provided with more generous parking areas. It is evidently not always the custom to do so, for in several cases new streets have been built which follow the style of the older thoroughfares, with parkings from one to three feet wide.

New Planting:

In selecting trees for new planting in the narrow parkings of Richmond we should endeavor to secure trees of small size and moderate growth, not only that these narrow

streets may not be overcrowded with foliage, but in order that the unsightly appearance of heaving sidewalks and broken curbs may be reduced to a minimum.

The *Platanus Orientalis* (*The Plane Tree*), so beautiful and hardy, and such a favorite for street use in other parts of the city is not suitable for the narrow streets of Staten Island although first rate on the wider thoroughfares. Its growth is so rapid that a large size is quickly obtained making the disruption of curb and sidewalk a continuous annoyance.

The *Quercus Palustris* (*The Pin Oak*) and the Ginkgo would be much more admirable trees for our purpose. The narrow spread and slow rate of growth make them well adapted for the narrow streets and scant parkings.

On the wider streets of Richmond where the sidewalks and parking areas are of reasonable width almost any satisfactory street tree such as the Norway Maple, Linden, Elm, etc., can be grown, since the general conditions of soil, moisture and air are excellent.

Existing Planting:

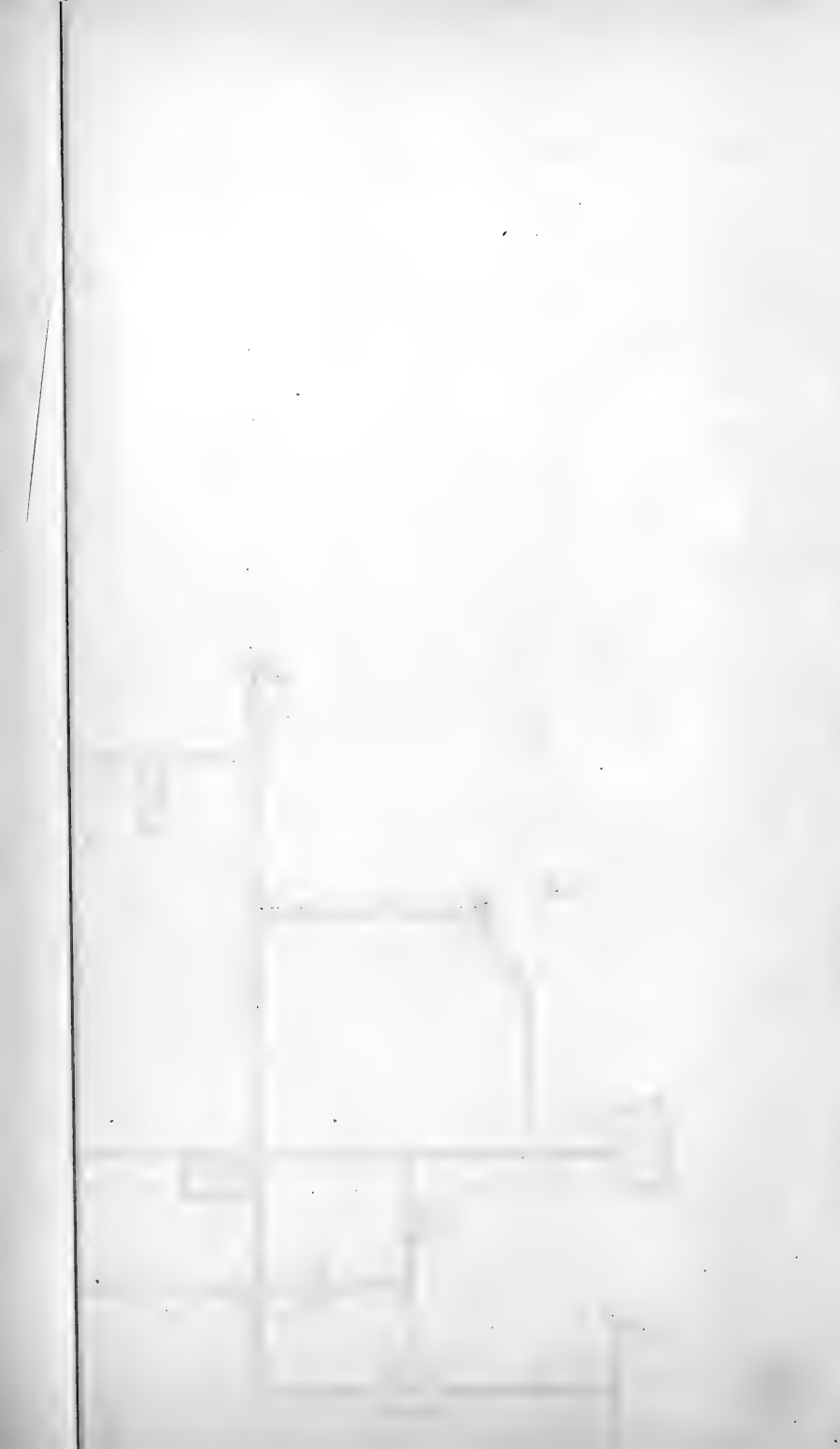
The trees which at present exist in Richmond, especially on the older streets are almost universally Soft or Silver Maples (*Acer Saccharinum*). Always a poor street tree, this tree is especially unsuitable here. Its rapid growth and large size have already played havoc with much of the curbing and sidewalk, while the tendency of the tree to be broken by wind and storm has caused them to be pruned severely and wrongly, which has given ugly shaped trees full of dead and dying branches.

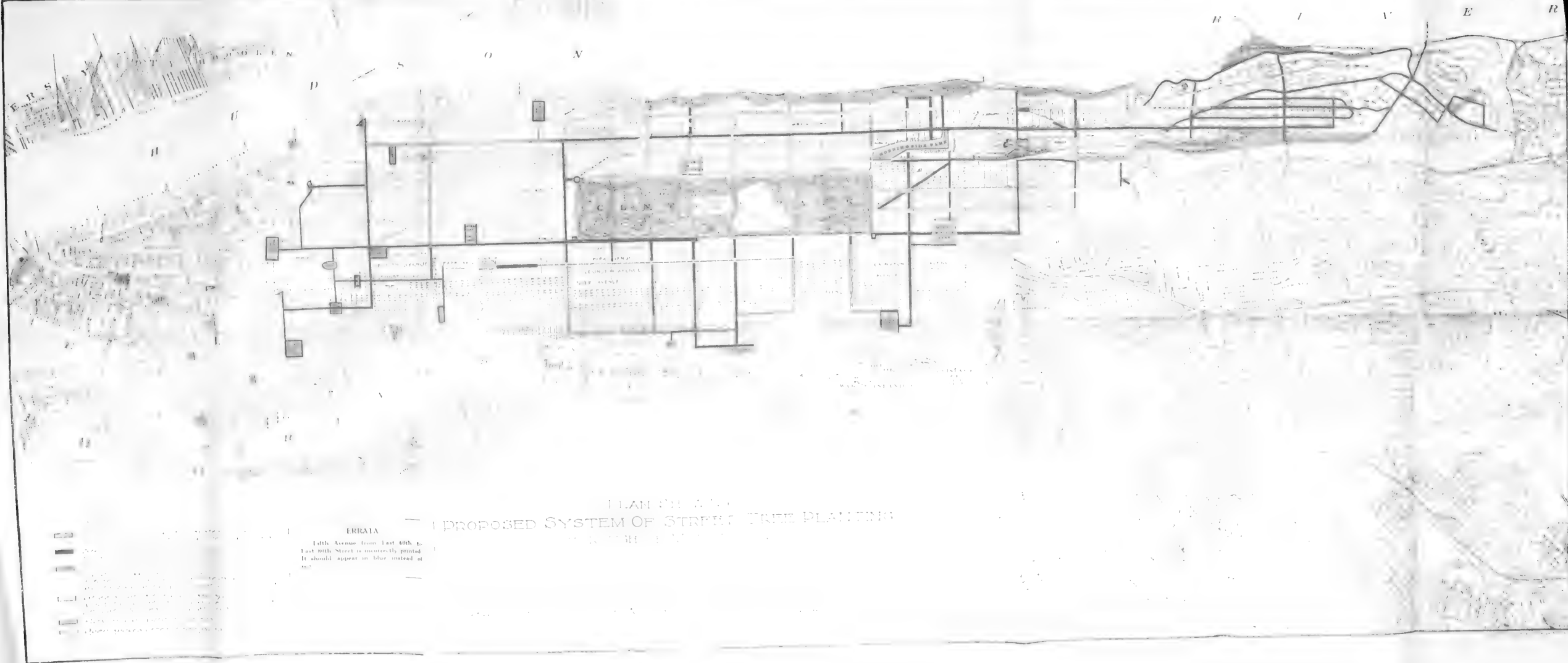
The great majority of these old trees contain much dead wood, and are not worth pruning since such a process must be a continual and expensive one if the trees are to be kept in any reasonably attractive condition. It will be far better to remove them as rapidly as possible and replace with better varieties of trees such as I have suggested.

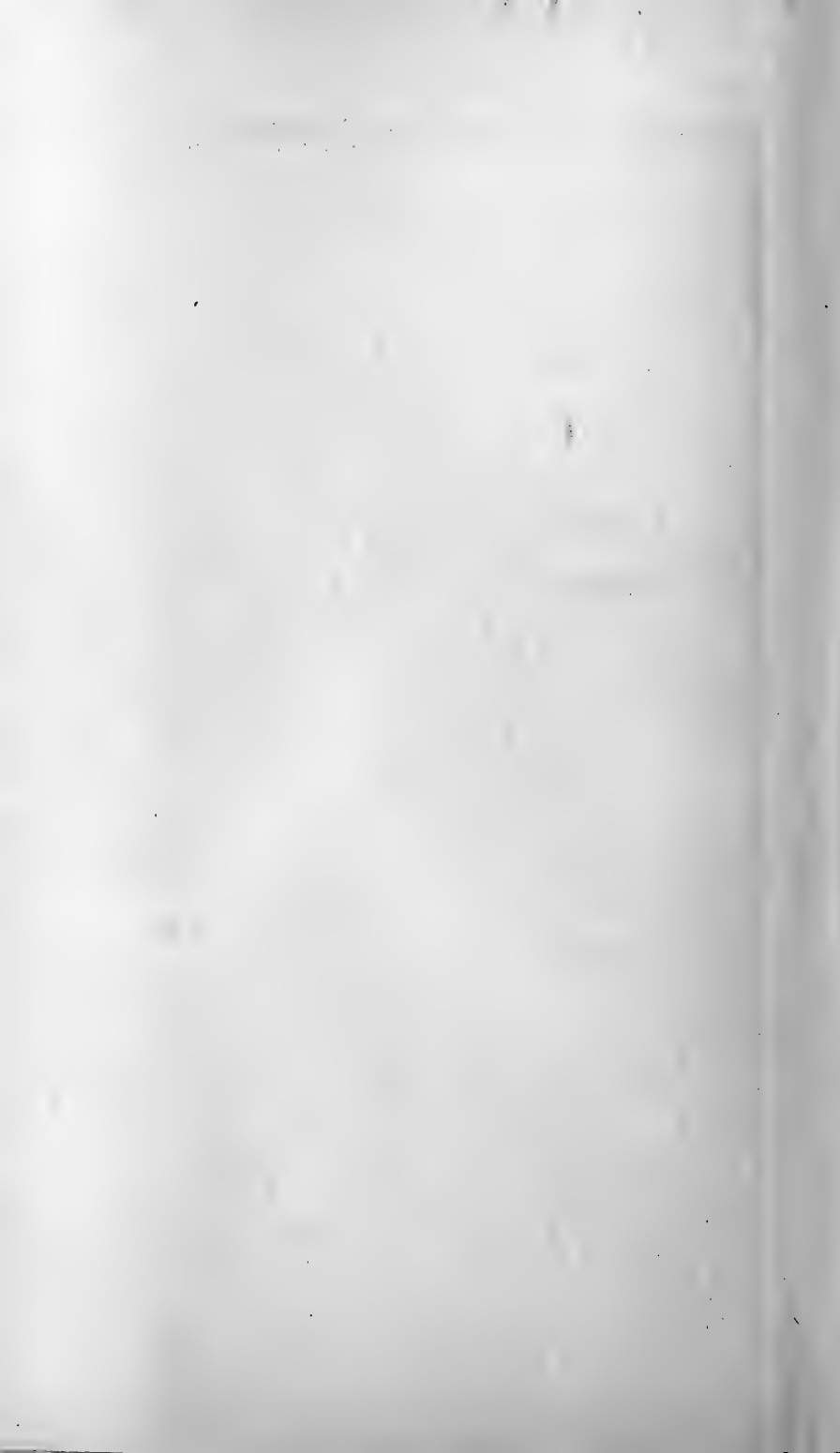
In order to reduce any public clamor which might arise at a wholesale removal of these trees, sufficient thinning

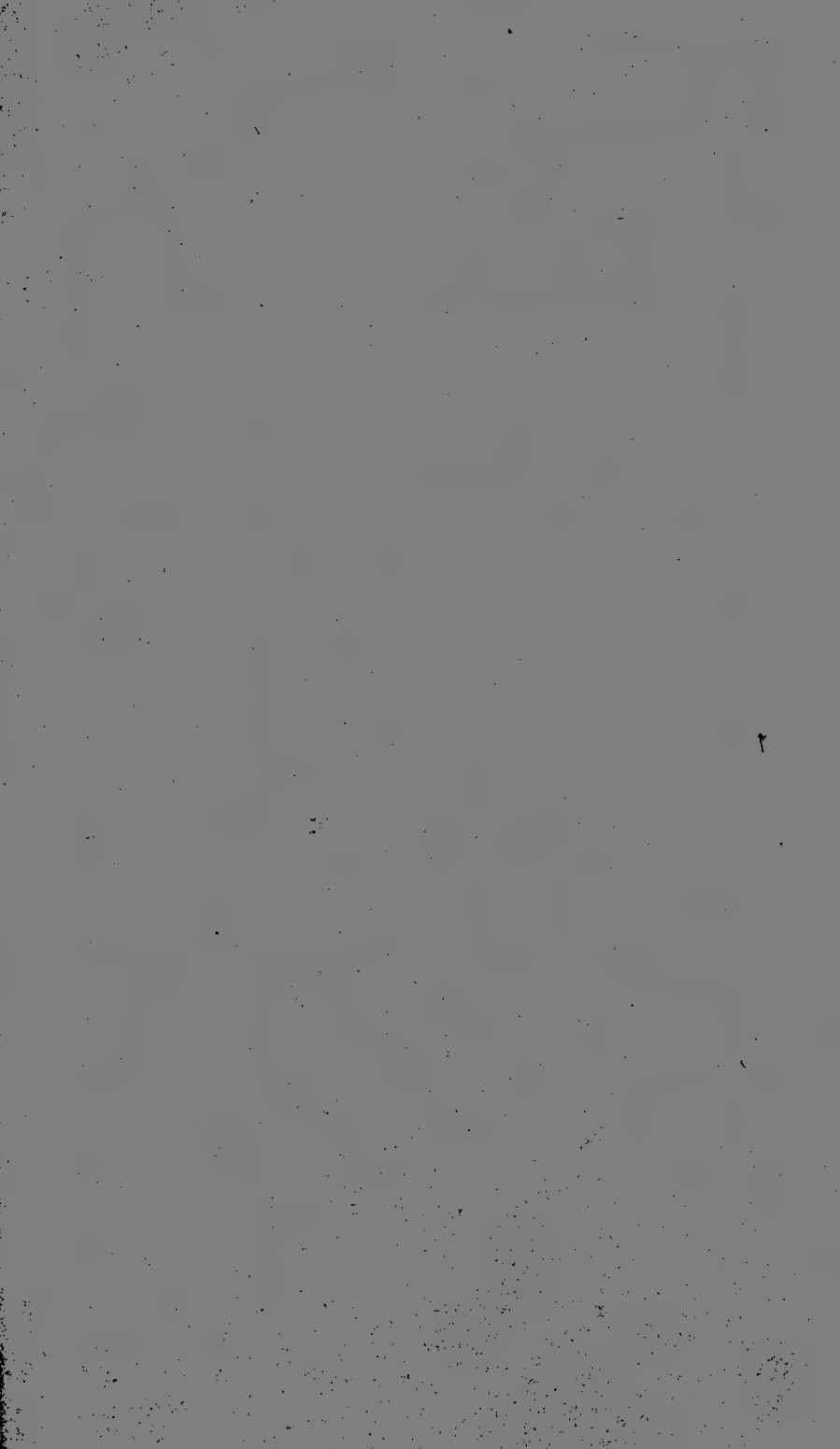
could be done to permit new planting at fifty-foot intervals with young trees. After a few years when the new trees have attained a fair size the remaining old maples could be removed, and would be scarcely missed.

There are no park areas worth mentioning at present existing in Richmond, so that no attempt has been made to suggest any system of tree planting as has been done for Manhattan. Doubtless in the near future a well organized park system will be worked out for this borough, and at that time a system of streets for tree planting should be decided upon to form those park connections which it is not possible to secure by parkways and boulevards.

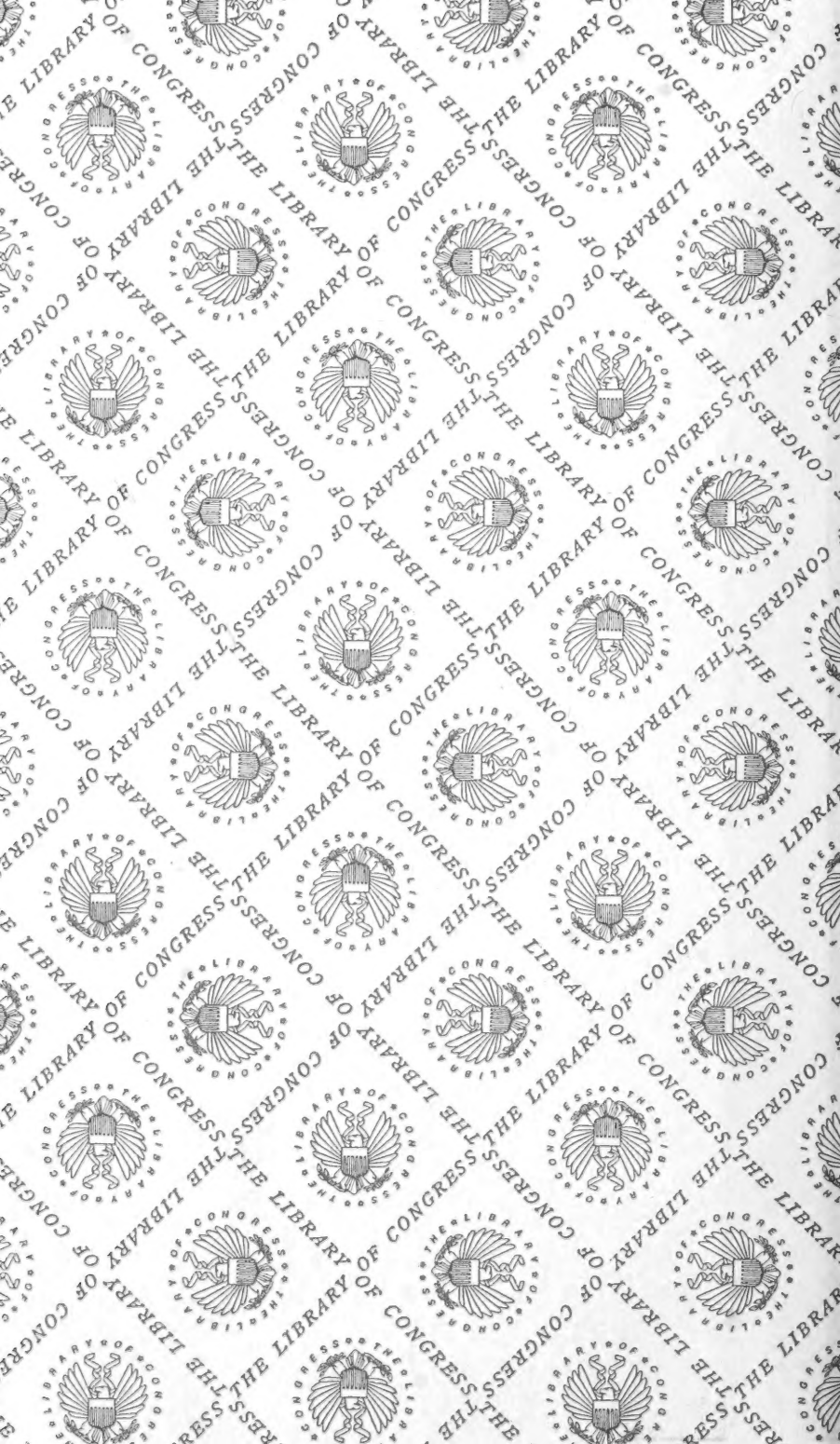


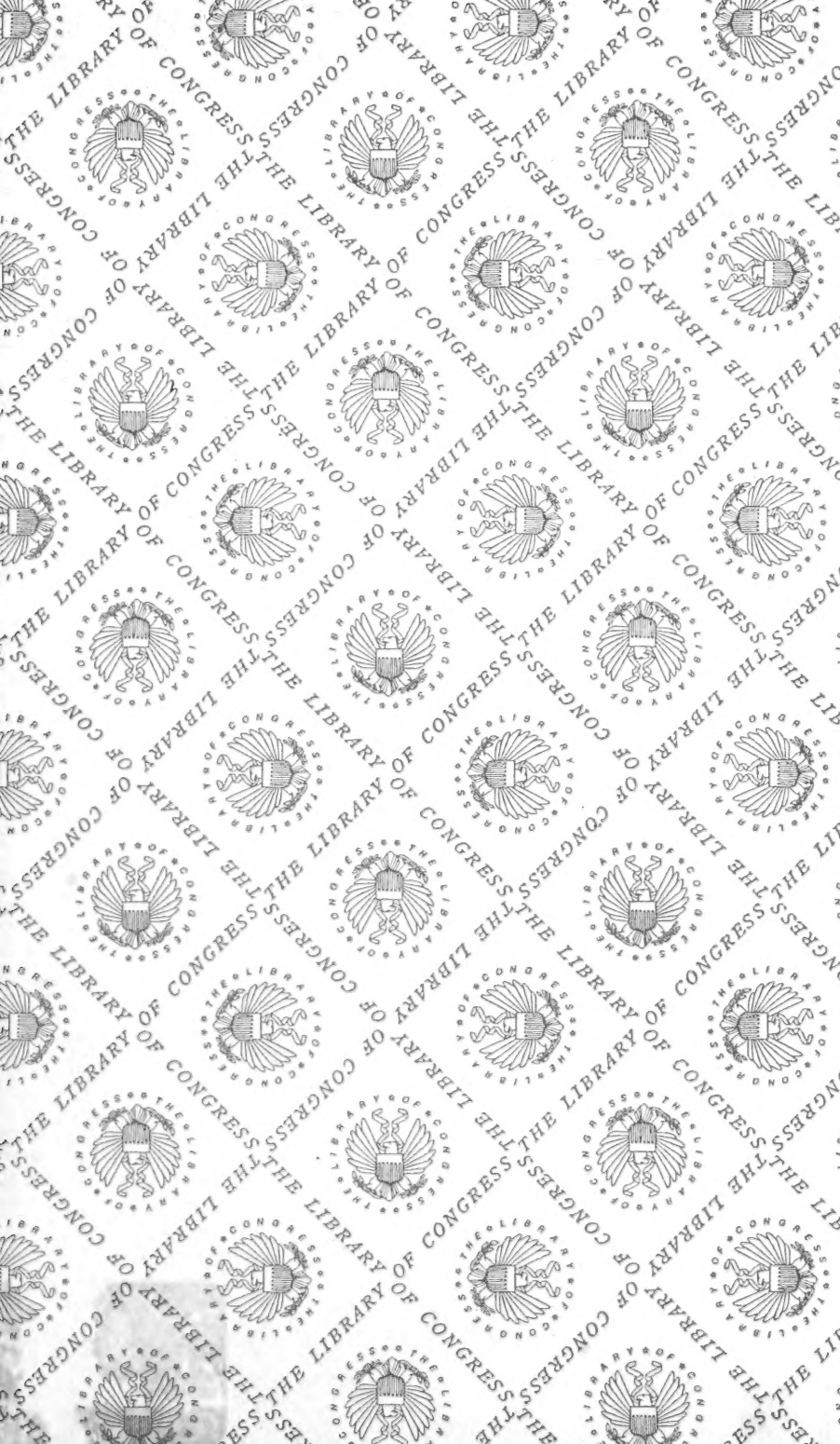






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